TESIS DOCTORAL

FISIOTERAPIA EN LA CERVICALGIA CRÓNICA. MANIPULACIÓN VERTEBRAL Y KINESIOTAPING.

DEPARTAMENTO DE FISIOTERAPIA

UNIVERSIDAD DE GRANADA

Manuel Saavedra Hernández

2012

Editor: Editorial de la Universidad de Granada
Autor: Manuel Saavedra Hernández
D.L.: GR 2905-2012
ISBN: 978-84-9028-228-1

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A mis padres,

A mis tres hijas y mi mujer

que es mi sol de media noche,

A Pablo y A mi abuela.

INDICE

RESUMEN:

El dolor de columna vertebral y más concretamente el dolor cervical, representa una de las causas más frecuentes de consulta en los centros de fisioterapia. La cervicalgia, es definida como dolor en columna cervical, aunque algunos autores lo describen también, como dolor localizado entre el occipucio y la tercera vertebra dorsal. El dolor cervical puede involucrar una o varias estructuras neurovasculares y musculoesqueléticas, pudiéndose presentar con o sin irradiación hacia los brazos (braquialgias) o la cabeza (cefaleas). La cervicalgia puede ser debida a trastornos estáticos y funcionales, a enfermedades de tipo inflamatorio, traumático, tumoral, infeccioso, o bien a desordenes de origen psicosomático. Un gran número de autores coincide en que el origen de las cervicalgias es fundamentalmente mecánico.

En este trabajo de investigación, el tamaño muestral ha estado constituido por 243 sujetos con dolor mecánico cervical, con una edad comprendida entre 18 y 60 años. Las variables de medida registradas han sido el diagrama corporal de localización de síntomas, escala numérica de rango de dolor, índice numérico de discapacidad, escala de kinesiofobia de Tampa, rango de movimiento cervical, rotación activa torácica, movilidad articular y respuesta sintomática a la movilización, examen específico de dolor cervical y radiculopatía, y cambio de rango global. Los sujetos de estudio fueron sometidos a distintos procedimientos de intervención en fisioterapia; técnicas de manipulación espinal dirigidas al segmento medio cervical, charnela cérvico-dorsal y dorsales altas; y vendaje neuromuscular (Kinesio Taping).

El vendaje neuromuscular y los procedimientos de terapia manipulativa han mostrado resultados similares en la reducción del dolor y en el aumento del rango de movilidad. Sin embargo, los sujetos que recibieron la técnica combinada de terapia manipulativa de columna cervical media y charnela cérvico-dorsal, han mostrado una mayor reducción de la discapacidad, con respecto al grupo de Kinesio Taping. Asimismo, los pacientes que recibieron terapia manipulativa combinada dirigida a dorsales altas, charnela cérvico-dorsal y cervical media, han mostrado una mayor reducción de la discapacidad,

en comparación con el grupo de pacientes al que se le administró un único procedimiento manipulativo a nivel cervical medio.

En la regla de predicción clínica, se han identificado diversos factores potenciales de pronóstico terapéutico en la mejora de la cervicalgia mecánica, entre los que se incluyen, un rango de extensión cervical inferior a 46º, una intensidad del dolor de 4.5 en la escala numérica de rango de dolor, hipomovilidad en la vértebra T1, test neurodinámico de miembro superior negativo y pertenecer al sexo femenino.

ABREVIATURAS.

ANOVA= Análisis de la Varianza de un Factor.

BMJ= British Medical Journal.

C1= Primera vértebra cervical.

C2= Segunda vértebra cervical.

C3= Tercera vértebra cervical.

C5= Quinta vértebra cervical.

C6= Sexta vértebra cervical.

C7= Séptima vértebra cervical.

CROM= Cervical Range of Motion (Rango de Movimiento Cervical).

EMG= Electromiograma.

Fig= Figura.

LRs= Likelihood ratios.

M= Media.

MCID= Minimal Clinically Important Difference (Diferencia Mínima Clínicamente Importante).

MDC= Minimal Detectable Change (Mínimo Cambio Detectable).

NDI= Neck Disability Index (Índice de Discapacidad Cervical).

nº= Número.

NPRS= Numeric Pain Rating Scale (Escala de Rango Numérico del Dolor).

QTF= The Quebec Task Force on Spinal Disorders.

RHB= Rehabilitación.

ROM= Range of Motion (Rango de Movimiento).

RPC= Regla de Predicción Clínica.

SD= Standard Derivation (Derivación Estándard).

SEM= Standard Error of Measurement (Medida de error Estándard).

SPSS= Statistical Product for Service Solutions.

T1= Primera vértebra dorsal.

T2= Segunda vértebra dorsal.

T3= Tercera vértebra dorsal.

T4= Cuarta vértebra dorsal.

T9= Novena vértebra dorsal.

TENS= Estimulación Eléctrica Transcutánea.

TJM= Thrust Joint Manipulation (Manipulación Articular de alta Velocidad).

TSK= Tampa Scale for Kinesiophobia (Escala de Kinesiofobia de Tampa).

ULTT= Upper Limb Tension Test (Test Neurodinámico de Miembro Superior).

VBI= Vertebrobasilar Insufficiency (Insuficiencia Vértebrobasilar).

y= Years (Años).

α= Alfa.

χ^2= Chi-cuadrado.

INTRODUCCIÓN.

1. Concepto de dolor mecánico cervical.

El dolor de columna vertebral y más concretamente el dolor cervical, representa una de las causas más frecuentes de consulta en los centros de fisioterapia, por lo que consideramos de capital importancia, el abordaje desde el punto de vista científico de esta patología, con el fin de ofrecer una atención sanitaria de máxima calidad.[1]

Siendo imprecisa como es la definición de cervicalgia, debido a su heterogeneidad desde el punto de vista biológico, etiológico, fisiopatológico y psicológico,[1,2,3,4] nos remitimos a su significado etimológico como "algia cervical", siendo por tanto un síntoma[5] definido como dolor en la columna cervical por la mayoría de los autores.[6] Aunque, también es definida por otros autores como un dolor localizado entre el occipucio y la tercera vértebra dorsal.[7]

El dolor cervical puede involucrar a una o varias estructuras neurovasculares y musculoesqueléticas como nervios, ganglios, raíces nerviosas, articulaciones uncovertebrales, articulaciones intervertebrales, discos, huesos, periostio, músculos y ligamentos;[1] pudiéndose presentar con o sin irradiación hacia los brazos o la cabeza, produciendo en ocasiones braquialgias o cefaleas de origen cervical[1,8,9,10] respectivamente. Igualmente, es causa a su vez de vértigo con origen cervicogénico,[1,11,12] por lo que es un proceso en el que, además de la lesión que se produce a nivel de las distintas estructuras implicadas en esta patología, hay que sumarle la alteración emocional que podría conllevar el dolor cervical.[2,3,4]

La cervicalgia puede ser debida a trastornos estáticos y funcionales, a enfermedades de tipo inflamatorio, traumático, tumoral, infeccioso, o bien a desordenes de origen psicosomático.[3,13] Un gran número de autores coincide en que el origen de las cervicalgias es fundamentalmente mecánico, ocasionado por posturas mantenidas de cabeza y/o brazos, por sostener o cargar pesos de forma estática, realizar movimientos repetitivos de la columna cervical o los miembros superiores, y también por no realizar pausas o descansos en el trabajo.[14-18]

2. Prevalencia y coste económico de la cervicalgia.

El dolor mecánico cervical representa, para cualquier país, un importante problema de salud.[19] Ha sido evidenciado que tanto la prevalencia como la duración del dolor cervical, es igual de importante que el dolor lumbar.[20,21] Aproximadamente, el 54% de los individuos han experimentado dolor cervical en los últimos seis meses,[22] y la incidencia de esta patología puede verse incrementada en el tiempo.[23,24] El dolor mecánico cervical tiene una prevalencia puntual comprendida entre el 9'5% y el 35%,[25-27], con una prevalencia a lo largo de la vida del 70%.[25] En el periodo de un año su rango, según los estudios más recientes, oscila entre el 16.7% y 75,1 %, con una media del 37.2%.[20] Un número importante de estos pacientes se recupera antes de las seis semanas.[25-28]

El dolor cervical produce a menudo una discapacidad importante, originando una pérdida de las horas de trabajo y un coste económico a los sistemas sanitarios,[22,25,29-32] traduciéndose por tanto, en unos costes socioeconómicos elevados.[33,34] Aunque la cervicalgia no supone para la vida una amenaza, si conlleva un detrimento de la calidad de ésta, que en reiteradas ocasiones, produce trastornos importantes de salud, generando dolor, déficit funcional, cefaleas, restricción de movimiento, síndromes vertiginosos, nauseas y/o vómitos, etc., con el consiguiente incremento de gasto sanitario y absentismo laboral.[4,35] El coste económico asociado al tratamiento de fisioterapia, farmacológico, ausencias en el trabajo, indemnizaciones, etc., en el paciente con cervicalgia es muy elevado, estando en segundo lugar, precedido por el dolor lumbar, en gastos de compensación a los trabajadores en EEUU.[36] En España, las derivaciones al servicio de fisioterapia por cervicalgia, ocupan el 10% del total de todas las demandas sanitarias.[37] Sin embargo, en países como Canadá este porcentaje se eleva al 30%, y al 15% en Gran Bretaña.[39]

Aproximadamente el 44 % de los pacientes que han padecido dolor cervical, van a desarrollar síntomas crónicos[30], y muchos continuarán presentando discapacidad moderada a largo plazo. [40] Aproximadamente, más de la mitad de estos pacientes, los cuales han padecido dolor cervical como resultado de un latigazo cervical, continuarán sufriendo sintomatología dolorosa durante más de 17 años, después de haber experimentado el traumatismo.[41] Existe un incremento del riesgo de dolor cervical crónico, un aumento de la severidad de los síntomas, y los episodios de dolor anteriores en individuos que se encuentran en el grupo de edad comprendido entre los 45 y los 59 años. [30,42]

La fisioterapia es a menudo, la primera aproximación terapéutica que reciben los pacientes con cervicalgia mecánica, suponiendo aproximadamente el 25% de todos los pacientes que solicitan los servicios de fisioterapia.[43] Jette et al [43] documentaron que los pacientes con dolor cervical, suponen aproximadamente el 25% de todos los pacientes que recibieron fisioterapia clínica.

El coste directo que ocasiona la cervicalgia al sistema sanitario, más concretamente, en la consulta de Atención Primaria, supone el 2% del coste total.[4, 44, 45] Incrementándose las cifras hasta alcanzar en algunos centros un 12%, si consideramos las pruebas diagnósticas, gasto farmacéutico y visitas al especialista.[4,44] También es importante considerar los costes indirectos, como es el absentismo laboral y la discapacidad ocasionados por esta patología, los cuales según diversos estudios, generan mayores gastos que los resultantes de costes directos.[35, 46-48] En un estudio económico realizado en Holanda en el año 1996, sobre los costes indirectos que produce la cervicalgia, se obtuvieron los siguientes resultados: Del total de los 686,2 millones del gasto sanitario en pacientes con cervicalgia, el 77% fueron costes indirectos.[29] Las personas diagnosticadas de esguince cervical postraumático, y que por ello son indemnizadas en la sociedad occidental, muestran una prevalencia de 300 casos por cada 100.000 habitantes.[47- 49]

3. Abordaje terapéutico de la cervicalgia mecánica.

La intervención más comúnmente prescrita para el tratamiento de dolor cervical, por la medicina general, son los analgésicos.[16, 50] A pesar de la gran incidencia de la cervicalgia, hay un gran déficit de evidencia científica sobre las técnicas y protocolos a seguir en el abordaje terapéutico, desde el punto de vista de la fisioterapia.[51] Las directrices más recientes para el tratamiento del dolor cervical las encontramos en The Quebec Task Force on Spinal Disorders (QTF)[52] y the *British Medical Journal* (BMJ) [53] guidelines.

El tratamiento del dolor cervical mecánico muestra una gran paradoja en los múltiples enfoques, escuelas y variedades terapéuticas, siendo aún escasas las grandes revisiones que cumplan los parámetros de calidad de la Medicina Basada en la Evidencia, y que justifiquen de manera definitiva el empleo de una u otra técnica.[54,55]

Tipo de Intervención	*Aguda*	*Crónica*
Ejercicio/reeducación neuromuscular	ND	A,I
Estimulación Eléctrica	ID	ID
Ultrasonidos Terapéutico	ND	C,I
TENS	C,I	ID
Tracción	C,I	C,II
Intervenciones RHB Combinadas	ND	ID
Termoterapia	ND	ND
EMG Biofeedback	ND	ND
Masaje	ND	ID

TENS: Estimulación Eléctrica Transcutánea; RHB: Rehabilitación; EMG: Electromiograma; ND: No Datos; ID: Datos Insuficientes; A: Beneficio Demostrado; C: No Beneficio Demostrado; Nivel I: Evidencia Obtenida a partir de Estudios Controlados Randomizados; Nivel II: Evidencia Obtenida a partir de Ensayos Clínicos Controlados.

Extraído de: Philadelphia Panel Evidence-Based Guidelines on Selected Rehabilitation Interventions for Neck Pain.[56]

4. Evidencia para la utilización de la manipulación vertebral en pacientes con dolor mecánico cervical.

La intervención mediante terapia manual es una estrategia de tratamiento utilizada para el abordaje de la cervicalgia.[57] La Guía para la Practica de la Fisioterapia (Guide to Physical Therapist Practice)[57] utiliza el término “movilización-manipulación” para referirse a las técnicas de terapia manual que conllevan un continuo movimiento pasivo de las articulaciones y tejidos blandos relacionados, y que son aplicadas a diferentes velocidades y amplitudes, incluyendo las de baja y alta velocidad. En concreto, el término “manipulación” en este tratado, se refiere específicamente a aquellas técnicas que son ejecutadas con alta velocidad y baja amplitud (thrust), mientras que la movilización hace referencia, a las técnicas que son desarrolladas a baja velocidad mediante un movimiento pasivo de una articulación.

Aproximadamente, el 37% de los terapeutas con una experiencia desarrollada en terapia manual, utilizan técnicas de manipulación y/o movilización en pacientes con dolor cervical, en su práctica clínica.[58] La efectividad de este tipo de intervenciones en pacientes con dolor cervical y cefaleas de origen cervicogénico, está siendo recientemente respaldada por un numeroso incremento de estudios de elevada calidad, a través de ensayos clínicos randomizados [59-65] y revisiones sistemáticas [1, 51, 66-68], en los cuales se demuestra la efectividad de la terapia manual como terapéutica en el abordaje de la cervicalgia y cefaleas. Sin embargo, las guías de la práctica clínica sobre el tratamiento del dolor cervical, raras veces sitúan la manipulación espinal como un tratamiento recomendado en este tipo de problemas[69]. No obstante, su utilización en el contexto clínico es cada vez más demandado por los pacientes, debido a sus potentes efectos analgésicos inmediatos observados en la práctica clínica habitual.

La aplicación de la terapia manual dirigida directamente sobre el raquis cervical, puede tener un cierto riesgo potencial. El riesgo de complicaciones se asocia con la insuficiencia de la arteria vertebral, y ha sido estimado como extremadamente bajo (aproximadamente en 6 de cada 10 millones de sujetos; 0.00006%). [70] Sin embargo, los estudios realizados hasta la fecha, han fracasado en la posibilidad de desarrollar procedimientos de test de screening, que sean capaces de identificar los pacientes con riesgo de sufrir este tipo de eventualidades antes del tratamiento.[71] Por lo tanto, se considera, que la manipulación cervical, puede tener algún tipo de riesgo.[71-76] Ante esta riesgo potencial, sería conveniente establecer la posibilidad de realizar manipulaciones a distancia del foco lesional, que puedan producir mejoras en el raquis cervical de forma más segura; o bien, estudiar la efectividad real de la manipulación cervical para valorar su relación con el riesgo asumible tras la adecuada realización de los tests clínicos discriminativos. Así por ejemplo, en una encuesta realizada en Canadá a profesionales de la fisioterapia, el 88% de los encuestados, estaban de acuerdo en que se deberían realizar todos los test de screening disponibles, previamente a la manipulación de la columna cervical.[58]

Expertos clínicos han sugerido que en pacientes con dolor cervical, se debe incluir el examen y tratamiento de la columna dorsal.[77-80] Debido a la relación biomecánica existente entre la columna cervical y la dorsal, probablemente las alteraciones en la movilidad articular en esta última, puedan servir como un elemento contribuyente al desarrollo de alteraciones cervicales. [81-83] Se ha demostrado que la manipulación y la movilización de las articulaciones a distancia sobre los pacientes con dolor cervical, pueden dar como resultado un efecto analgésico inmediato.[84-87] Por estas razones, se sugiere, que incorporar la manipulación torácica, así como, las movilizaciones del segmento cervical, a la manipulación de la columna cervical, puedan ser intervenciones que tengan un efecto terapéutico.[88]

Sin embargo, de forma similar a como ocurre en el dolor lumbar, el dolor cervical mecánico, es un problema de etiología heterogénea, pudiendo ser éste originado por problemas a nivel articular, discal, neurológico, ligamentario y muscular.[89-101] Incluso en poblaciones consideradas como un grupo homogéneo, por ejemplo, pacientes sin antecedentes traumáticos con dolor no agudo cervical, existen diferencias considerables en cuanto a los exámenes derivados de la exploración clínica.[102] Los procedimientos de examen clínico estandarizados, han mostrado poco éxito en identificar las causas patoanatómicas de los síntomas en este tipo de pacientes con dolor cervical mecánico.[95, 103, 104] Debido a la variabilidad que existe en la presentación clínica en cuanto a la etiología del dolor cervical, parece evidente, que no todos los pacientes con dolor cervical mecánico, van a responder de manera positiva a la manipulación de columna cervical, charnela cérvico-dorsal y torácica. No obstante, es esencial identificar y clasificar a aquel subgrupo de pacientes homogéneos con dolor cervical mecánico, que son susceptibles de responder a las manipulaciones previamente mencionadas.

Actualmente, se está estableciendo una tendencia a la utilización de la manipulación de la columna dorsal, en el abordaje del dolor cervical. Pho y Godges [105] utilizaron un tratamiento multimodal en el abordaje de un paciente que presentaba alteraciones asociadas con latigazo cervical. El inicio de los síntomas fue bastante agudo, y no permitió el tratamiento de forma directa sobre el cuello, de manera que los autores decidieron focalizar el tratamiento en la columna torácica. Como resultado de este estudio, el paciente experimentó un total retorno a la actividad funcional, por lo que los autores concluyeron que, la columna torácica alta puede ser el origen de los síntomas en algunos pacientes con dolor cervical. Parkin-Smith et al [106] compararon la efectividad de los tratamientos consistente en manipulación de la columna dirigida al segmento cervical y al torácico en un grupo de pacientes con dolor mecánico cervical. Los pacientes fueron randomizados en dos grupos, recibiendo 6 sesiones de terapia manipulativa durante un periodo de 3 semanas. El resultado del estudio demostró que ambas manipulaciones, cervical y columna dorsal alta, con respecto a la intervención exclusiva sobre la columna cervical, no mostró un beneficio suplementario sobre la discapacidad. Sin embargo, el estudio exhibió una pobre potencia estadística sugiriendo que, posiblemente existió un error metodológico que podría justificar la falta de resultados. En definitiva, se informó que algunos de los pacientes recibieron masaje del tejido blando y por tanto no sabemos si las variables añadidas podrían haber afectado a los resultados de estos pacientes.

En línea con los estudios liderados por Flynn [86] y Cleland,[87] y más recientemente por Fernández de las Peñas,[107] centrados en los efectos inmediatos de la manipulación de la columna torácica en pacientes con dolor cervical mecánico, se ha demostrado que en un grupo de pacientes con alteraciones asociadas a latigazos cervical, tratados mediante manipulación de la columna torácica, se produce una mejora clínica en la reducción de dolor, valorada mediante escala visual analógica, en comparación con aquellos sujetos, que no fueron tratados mediante manipulación torácica.

Una encuesta administrada a clínicos que practican terapia manual mostraron que la columna torácica es la región de la columna más manipulada a pesar del hecho de que muchos pacientes manifiestan dolor cervical.[108] Sin embargo, el mecanismo preciso por el cual la manipulación de la columna torácica mejora el dolor cervical, así como, el grupo de pacientes más proclives a la mejora clínica, no está todavía muy demostrado.

4.1. Fundamentos biomecánicos para el tratamiento a distancia de la cervicalgia crónica.

Norlander et al[81-83] informaron de la relación existente entre la articulación cérvico-dorsal y el dolor en región cervical y hombro, además del dolor referido a columna dorsal alta, justificando de este modo el nexo biomecánico existente entre la columna cervical y dorsal alta, así como, el vínculo existente entre la cintura escapular y la columna dorsal. En un estudio inicial, Norlander et al[81] evaluaron la movilidad de la unión cervicotorácica e investigaron si la hipomovilidad estaba correlacionada con los síntomas cervicales y de hombro; determinando que la presencia de hipomovilidad en la unión cervicotoracica estaba directamente correlacionada con la presencia de dolor cervical. Es por ello, que los sujetos que presentaban movilidad reducida, exhibieron un incremento significativo de su Odds Ratio (2,7) en la presencia del dolor cervical durante al menos 7 días en los últimos 12 meses, comparándolos con los individuos asintomáticos. En un estudio de seguimiento,[82] se demostró que en el mismo grupo de pacientes del estudio inicial[81], el riesgo relativo de experimentar dolor en los dos años siguientes al estudio, oscilaba entre el 2,7 y 3,3 en aquellos casos donde existía una hipomovilidad de la región cervicotorácica. Los autores sugirieron que la hipomovilidad de la unión cervicotorácica, podría ser posiblemente, una variable predictiva para la identificación de pacientes que son capaces de desarrollar dolor cervical en el futuro.

En un estudio transversal sobre 281 trabajadores industriales, Norlander et al[83] demostraron que la hipomovilidad del segmento C7-T1 está directamente relacionada con los síntomas en el dolor cervical y de hombro. La movilidad reducida de la unión cervicotorácica, explicó el 14% del dolor cervical de esta población. Los autores concluyeron que el ajuste de la movilidad a nivel de C7-T1 y de T1-T2, podría estimular los mecanorreceptores localizados en las articulaciones cigoapofisarias, las cuales pueden dar como resultado la aparición del dolor cervical. Asimismo, se ha mostrado que la reducción de la movilidad en la unión cervicotorácica, podría estar provocada o relacionada con una postura inadecuada. Según el estudio de Griegel-Morris et al.[109], una postura inadecuada está directamente relacionada con el dolor cervical.

Esta restricción de movilidad junto con la alteración postural prolongada en el tiempo, pueden dar como resultado, la degeneración de la columna torácica superior y columna cervical.[110] En el estudio de Arane et al,[110] identificaron una correlación entre la degeneración discal del segmento torácico superior y el dolor cervical en un 13,4% de los pacientes con dolor cervical, identificado a través de resonancia magnética. Quizá la restauración de la movilidad de estos segmentos a través del uso de técnicas manipulativas de alta velocidad, puede ser un método efectivo en la restauración de la movilidad segmentaria, reduciéndose así, la estimulación de los mecanorreceptores, y dando como resultado la reducción del dolor.

Las membranas sinoviales inervadas por terminaciones nerviosas nociceptivas, las cuales podrían llegar a ser pinzadas por las articulaciones cigoapofisarias, podría ser una superficie potencialmente capaz de dar como resultado dolor cervical [111]. También es probable, que los discos meniscales fibroadiposos atrapados a nivel de estas articulaciones puedan dar como resultado la aparición del síndrome doloroso.[98] Considerando que las articulaciones cigoapofisarias de los segmentos cervical y torácicos pueden ser potenciales fuentes de dolor hacia la región de la columna cervical, es posible que la manipulación de estos niveles, permita la liberación de este espacio, facilitando una mejor funcionalidad, y originando como resultado una reducción del dolor cervical.[112]

4.2 Zona de Transición C6-C7, C7-T1 y T1-T2.

En un análisis morfológico de la región cervicotorácica, se rebeló que los platillos superiores de C6 e inferiores de T4 exhibían características morfológicas similares.[113] En análisis radiográfico se reveló que el ápex de la curvatura cervicotorácica es la vértebra T3 para la población joven, esto va cambiando progresivamente conforme se van cumpliendo los años y trasladándose el ápex de la curva progresivamente hacia C7-T1.[114] Quizá esto está relacionado con un incremento de espesor de los cuerpos vertebrales durante el proceso de envejecimiento.[115] Arana et al[110] en un estudio con 166 pacientes, investigaron las relaciones entre la degeneración de los discos en la columna torácica superior y el dolor cervical. Los resultados revelaron que los cambios degenerativos a nivel de los segmentos T1-T4 están significativamente relacionados con la presencia de dolor cervical.[110]

La posición de la columna cervicotorácica, puede dar como resultado alteraciones de la distribución homogénea de carga en estas dos regiones vertebrales, y por lo tanto, la biomecánica del movimiento estará alterada, dando lugar a la producción de síntomas dolorosos a consecuencia de la disfunción de la columna cervical y torácica.[116] Por lo tanto, es esencial observar que la cifosis torácica superior presente algún tipo de desviación, la cual podría ser un contribuyente fundamental para los pacientes con dolor cervical mecánico.[117] De hecho un número importante de autores [80, 118, 119] han sugerido que tratando la columna torácica y cervicotorácica en pacientes con dolor cervical mecánico, se podrían conseguir mejorías terapéuticas importantes. Considerando la íntima relación entre la columna cervical y la columna torácica superior, es posible que la manipulación dirigida directamente a la columna dorsal superior y charnela cérvico-dorsal podría mejorar directamente los síntomas asociados con dolor cervical mecánico. Por tanto, la relación C7-T1-T4 parece ser una fundamentación razonable para el tratamiento de los pacientes con dolor cervical, que sufren alteraciones de la movilidad en la columna cervicotorácica, pudiendo ser esta región un contribuyente fundamental para las alteraciones musculoesqueléticas cervicales.[80] Diferentes estudios[120] han investigado la contribución que tienen los patrones de dolor referido desde las articulaciones cigoapofisarias cervicales, demostrando que estas articulaciones están claramente relacionadas con el dolor cervical.

4.3. Influencias neurofisiológicas para la fundamentación del uso de la manipulación vertebral en la cervicalgia crónica.

Las articulaciones cigoapofisarias presentan una rica inervación y presencia de mecanoreceptores.[111,121,122] La manipulación de la columna puede estimular estos mecanoreceptores dando como resultado, alteraciones en las aferencias sensoriales a nivel medular. Existen distintas teorías que afirman que la manipulación de la columna puede también alterar los patrones sensoriales producidos por los mecanoreceptores dentro de los tejidos inervados en una de estas articulaciones cigoapofisarias.[123] Asimismo, existe la posibilidad de que la manipulación espinal, pueda disminuir el dolor a través de la inhibición de la nocicepción proveniente de los distintos receptores articulares cervicales.

Un importante número de estudios[85,124-127] han tenido como objetivo evaluar la actividad del sistema nervioso simpático, en un intento de cuantificar los efectos fisiológicos de la manipulación espinal (técnicas de movilización y manipulación). Muchos de estos estudios[127] han demostrado que la manipulación espinal produce una respuesta simpático-excitativa, estadísticamente significativa, cuando se compara con un placebo o un grupo control. Todos los estudios mencionados anteriormente, utilizaron la conductancia de la piel como medida de la activación periférica del sistema nervioso simpático. Algunos de estos estudios,[124] han demostrado que la movilización-manipulación de la columna, va acompañada de un efecto hipoalgésico, con una magnitud suficiente como para producir cambios estadísticamente significativos al ser comparados con grupo placebo o control. Vicenzino et al[85] realizaron un estudio para evaluar los efectos de la movilización cervical usando el procedimiento de Maitland [118] sobre el umbral doloroso a la presión y la conductancia de la piel, en pacientes con epicondilitis. Los resultados demostraron que no solo hubo un incremento en la respuesta simpático-excitatoria e hipoalgésica, sino también, una correlación positiva entre estas variables, lo cual plantea la posibilidad de una relación entre ambos efectos de la terapia manual, cuya dirección causa-efecto deberá ser estudiada en futuros estudios. Aunque la terapia manual genera estos resultados, su génesis y relación no están claramente establecidas. Se han desarrollado diferentes marcos teóricos, teniendo como referencia la posible acción sobre el sistema de control central encefálicos[58,59] que pudieran producir una estimulación de mecanismos inhibitorios descendentes.[85,128-130]

4.4. Efectos neuromusculares de la terapia manual.

4.4.1 Inhibición muscular.

Un inadecuado hábito postural puede incrementar la cifosis torácica y la lordosis cervical, pudiendo ser esto un factor contribuyente fundamental para el dolor cervical. Griegel y Morris[109] han demostrado que las anormalidades de las posturas a nivel cervical y torácico, están asociadas con un incremento de las incidencias en el dolor de columna lumbar alto, dolor cervical y cefaleas. Se teoriza que un habito postural inadecuado puede estar asociado con un patrón de desequilibrio muscular específico, en el que los músculos posturales llegan a estar acortados y tensos, mientras que los músculos fásicos (músculos encargados del movimiento) están alargados o inhibidos.[131,132] Distintos estudios han demostrado que la manipulación espinal produce como resultado un cambio inmediato en la actividad electromiográfica, con el consiguiente incremento en la activación muscular a nivel de músculo trapecio, musculatura espinal, músculo longísimo y musculatura intertransversa en individuos asintomáticos.[133,134] Se podrían establecer indicios de que las mejoras en el dolor cervical después de la manipulación de la columna cervical y torácica, pueden estar parcialmente atribuidas a cambios en los tejidos blandos, y de manera similar, al fenómeno observado en la columna lumbar. Se ha documentado en la literatura, que un habito postural inadecuado, a menudo produce dolor, desequilibrio muscular y restricciones en el movimiento,[22,23] estando demostrada la relación existente entre unos inadecuados hábitos posturales y una disminución de la actividad muscular en trapecios.[135] Quizá el músculo trapecio esté débil o inhibido en pacientes con dolor cervical, por lo tanto, la manipulación de la columna cervical y torácica puede mejorar este desajuste y contribuir a una remisión del dolor y mejora funcional.

Janda[132,136] describió un síndrome, denominado "síndrome cruzado superior", en el que los pacientes presentan una anteriorización crónica de la cabeza, dando como resultado un acortamiento de los músculos pectoral mayor y menor, trapecio superior, elevador de la escápula y del músculo esternocleidomastoideo. Estas restricciones de la flexibilidad, están comúnmente asociadas a la combinación de la debilidad de los músculos trapecio medio e inferior, serrato anterior, romboides y de los músculos flexores cervicales profundos.[24,132,136]

Griegel-Morris et al[109] demostraron que la severidad de la anteriorización postural de la cabeza y el incremento de la cifosis torácica, están directamente relacionadas con la incidencia de dolor interescapular. Raine y Twomey[137] sugirieron que estos déficit posturales podían dar como resultado una incongruencia en las superficies articulares de las vértebras, conllevando a su vez, una distribución inadecuada de las fuerzas a este nivel. El estrés postural crónico de estas articulaciones, inhibe a la musculatura periarticular, dando como resultado que los músculos antagonistas estén acortados y tensos.[137]

Se ha propuesto que la inhibición muscular puede darse como resultado de una inflamación o lesión articular.[138,139] La inhibición se define como la incapacidad para producir un reclutamiento de las unidades motoras de un determinado grupo muscular funcional, para que este pueda dar como resultado una contracción máxima voluntaria.[140-142] Algunos autores[143-145] ponen de manifiesto la existencia de varios patrones de inhibición muscular en pacientes con dolor lumbar. Grabiner et al[145] demostraron que los pacientes con dolor lumbar exhiben una reducción significativa de la funcionalidad en la excitabilidad paraespinal, cuando se comparan con un grupo de controles asintomáticos. Hodges y Richardson[144] demostraron un retraso significativo en la contracción del músculo transverso abdominal durante los movimientos de la extremidad superior en un grupo de pacientes con dolor lumbar. Hides et al[143] demostraron que existe una inhibición del segmento del músculo multífido en los pacientes con dolor lumbar. Los autores de estos tres artículos mencionados previamente, pronosticaron que, un determinado número de factores contribuyentes, que incluirían la inflamación, dolor, estiramiento ligamentoso o irritación de los tejidos capsulares y músculo-esqueléticos, puede haber causado la inhibición muscular.

Varios estudios han demostrado que la inhibición muscular que ocurre en los músculos cuádriceps e isquiotibiales, puede ser producida por una articulación en disfunción, en individuos que presentan artrosis incipiente de la rodilla, incluso sin que exista la presencia de dolor o inflamación articular.[139,146] La patología articular, en ausencia de dolor, puede potencialmente inhibir la actividad muscular, dando como resultado una reducción de la fuerza del músculo.[138] Un mecanismo neurofisiológico posible, para esta inhibición muscular, es la aferencia anormal de los receptores articulares que están sensibilizados en la articulación disfuncional, produciendo una inhibición de los músculos que cruzan dicha articulación.[139] La idea de que la inhibición muscular de origen articular puede impedir significativamente la restauración de la fuerza muscular y la recuperación funcional, debería ser reconocida, dentro del ámbito clínico.

Varios estudios[140,141,147] han investigado los efectos sobre la musculatura de las extremidades, utilizando técnicas manipulativas espinales. Suter et al[140,141] demostraron que la disfunción sacroilíaca está directamente relacionada con la inhibición de la musculatura del músculo cuádriceps. Los autores pensaron, que este hecho pudo ser debido a que la musculatura pertenecía al mismo segmento metamérico de la articulación sacroilíaca (L2 – S2), también suplementados por la inervación del cuádriceps (nervio femoral). La manipulación de la articulación sacroilíaca de estos pacientes da como resultado una reducción significativa de la inhibición muscular inmediatamente después de la aplicación de la técnica. En un ensayo randomizado, Cibulka et al[147] demostraron que los sujetos con alteraciones de la musculatura isquiotibial, tenían relación directa con la disfunción sacroilíaca.

De manera especifica con la temática de este trabajo y en relación con los cambios descritos previamente en diferentes estructuras musculoesquleticas, a menudo envueltas en la aparición de dolor musculoesquelético; Suter y McMorldan[142] demostraron que la musculatura del bíceps branquial esta inhibida cuando existe dolor cervical crónico. La inhibición fue reducida significativamente inmediatamente después de la manipulación cervical a nivel de C5-C6-C7.[142] Muchos autores han teorizado, que la manipulación de la columna aplicada en forma de técnicas de alta velocidad y baja amplitud, puede activar los mecanoreceptores alrededor de la articulación manipulada. Estos cambios en el input sensorial pueden dar como resultado la restauración de la funcionalidad de los músculos, pudiendo ser medida a través de la reducción de la inhibición y el incremento de la fuerza.[146]

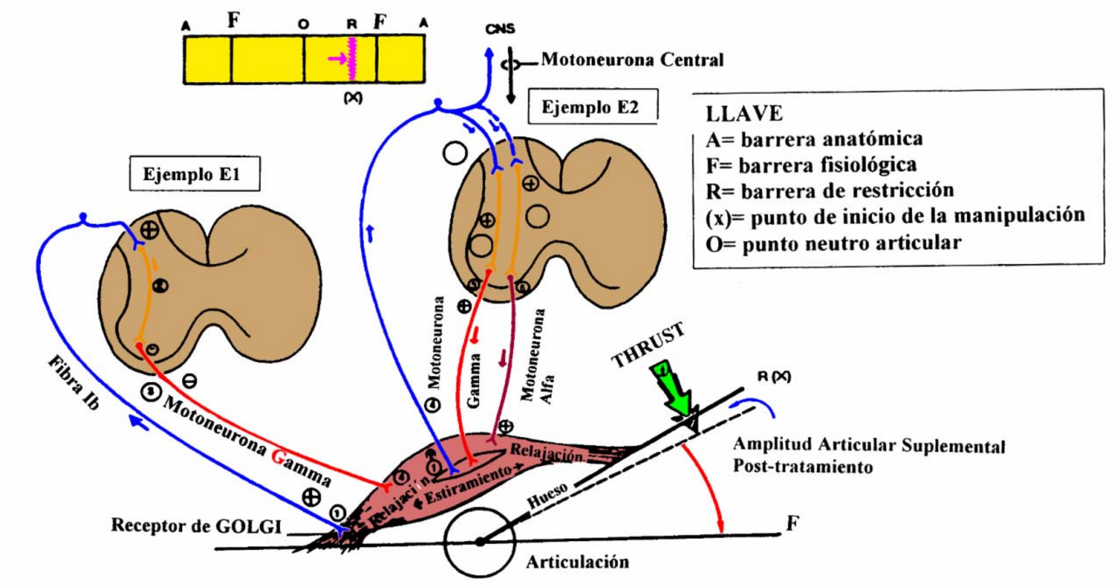
Quizá uno de los elementos de mayor relevancia de este trabajo, sean los estudios[149-151] en los que se han demostrado los efectos beneficiosos de la movilización de las articulaciones en la fuerza de los músculos, estando en consonancia con estos autores, en que las técnicas de movilización dirigidas a la disfunción de las estructuras articulares, pueden servir para facilitar el proceso de rehabilitación.

Se cree que las movilizaciones de las articulaciones modifican el patrón de activación de los mecanoreceptores, dando como resultado una reducción de la inhibición neural, facilitando la activación de la musculatura implicada en la aparición de estos síntomas, y consecuentemente, incrementando la posibilidad de reclutamiento y por tanto de fuerza muscular en la región manipulada.[150,151] Una articulación disfuncional, produce una información aferente que da lugar a una inhibición muscular de origen articular, esta inhibición muscular da lugar a una reducción de la descarga motora en los músculos que cruzan la articulación.[139] Sin embargo, incluso ante la ausencia de dolor, dicha inhibición de origen articular, puede dar como resultado una debilidad muscular.[138] Se cree que el incremento en la fuerza puede estar relacionada por una reducción de la inhibición de origen articular ocasionada por los impulsos aferentes, desencadenados por la manipulación de las articulaciones que se encuentran en disfunción. Se entiende que esta inhibición muscular artrogénica puede impedir significativamente la restauración de la fuerza muscular, por lo cual, esto tiene que ser considerado, con el fin de conseguir una rehabilitación efectiva de los pacientes.[138,138] Clínicamente esto podría sugerir que el método más efectivo para conseguir una mejora de la fuerza, consistiría en eliminar la inhibición muscular de origen articular mediante la manipulación, y posteriormente, llevar a cabo la instalación de un programa de mejora del control motor y desarrollo de la fuerza en la región afectada.

4.4.2. Sobre el control motor en la unión Cervicotorácica.

Aunque el mecanismo exacto por el cual la manipulación reduce el espasmo e incrementa la fuerza, aún no ha sido clarificado, los investigadores han informado que existen cambios en la actividad eléctrica muscular,[152] y una reducción del espasmo muscular reflejo.[153] A través de la manipulación, podemos producir un impacto en la musculatura que esta relacionada directamente con estas áreas, o que tiene también un punto de origen en la región a manipular. Está contrastado y estudiado, que existe un número de músculos que están unidos a los segmentos cervical y torácico.[154] También está clarificado que en ambos grupos de pacientes con dolor cervical crónico y trastorno asociado a latigazo cervical, muchos de estos músculos exhiben una reducción de la fuerza y resistencia.[155-163]

Es posible que el desequilibrio muscular pueda dar como resultado una alteración postural,[136] produciendo un estrés excesivo sobre la columna cervical, el cual puede afectar a estructuras relacionadas directamente con el dolor cervical.



La inhibición de las motoneuronas alfa y gamma se debe al estiramiento del huso neuromuscular y a la estimulación de los receptores de GOLGI tendinosos.

Por tanto, la manipulación espinal es un procedimiento fisioterapéutico con un amplio marco conceptual, y con una corta pero densa trayectoria, como foco de interés en la investigación en Fisioterapia. A la vista de todos sus posibles mecanismos de acción dentro de la cervicalgia crónica, sería interesante evaluar el perfil de los pacientes que se verían especialmente beneficiados con la aplicación de la manipulación vertebral. La obtención de dicho perfil reduciría la aplicación indiscriminada de recursos terapéuticos en estos síntomas discapacitantes, facilitando la disminución del coste sanitario derivado del tratamiento de la cervicalgia.

5. Reglas de predicción clínica en Fisioterapia (RPC).

Los terapeutas que utilizan frecuentemente la manipulación de columna cervical, dorso-cervical y dorsal como parte de sus tratamientos, tienen la noción de que algunos pacientes con este tipo de dolor en la región cervical, responden de forma drástica y rápida, mientras que otros experimentan poca o ninguna mejoría. Los cambios que los terapeutas están apreciando en la respuesta a estas técnicas, es muy dependiente de las características individuales de cada paciente. Ningún sistema de clasificación es, en última instancia, una prueba diagnóstica. Cada proceso diagnóstico está compuesto por muchos procedimientos diagnósticos individuales, diseñados para obtener una fiabilidad y reproductividad, asignando así, una etiqueta diagnóstica a cada paciente, con el objetivo de mejorar el proceso decisorio en lo que concierne a la determinación de la intervención más eficaz. Existen guías de práctica clínica para el tratamiento de pacientes con dolor cervical, que se basan en los resultados de las reglas de predicción clínica, [168] y existen pocas evidencias que den soporte al uso de la manipulación cervical, cervico-dorsal y torácica, en los pacientes con dolor cervical. Sin embargo, la guía de prácticas clínicas y los resultados de los ensayos clínicos randomizados, están diseñados para mejorar la toma de decisiones de un grupo de pacientes con dolor cervical. [169] Los terapeutas obviamente, no tratan grupos de pacientes, por lo tanto, las guías de prácticas clínicas y los resultados derivados de los ensayos clínicos randomizados, no son los sistemas ideales para ayudar al clínico en la práctica diaria, para decidir si un determinado paciente con un dolor específico de cuello puede beneficiarse de una intervención concreta.

La RPC es una herramienta que puede ser utilizada por el clínico para resolver este tipo de dilemas.[170,171] La propuesta de una RPC es mejorar la seguridad del terapeuta a la hora de predecir y diagnosticar los resultados derivados de una determinada intervención.[170,171] Existen varias RPC como por ejemplo: mejora de la fiabilidad en el diagnóstico de las fracturas de tobillo en individuos con lesiones agudas de tobillo,[172] la predicción de probabilidad de muerte dentro de los cuatro años para individuos con enfermedad coronaria,[173] y la determinación de cuando una radiografía cervical es necesaria para los pacientes que han experimentado un traumatismo cervical. [174] El proceso para el desarrollo y valoración de una RPC ha sido descrito en distintas referencias bibliográficas. [170,171] Aunque las RPC han sido desarrolladas para mejorar la fiabilidad de ciertos diagnósticos, la importancia de parte de este estudio en el que desarrollamos una RPC con el objetivo de predecir el resultado de un tratamiento determinado, es original por nuestra parte. El desarrollo de una RPC utiliza propiedades diagnósticas de sensibilidad, especificidad, valor predictivo positivo y valor predictivo negativo, bajo la base de los pacientes individuales. Por lo tanto su interpretación estará aplicada y dirigida a los individuos, no a los grupos de pacientes.

El primer paso en el desarrollo de una RPC es la creación de una regla. [170,171] Esto requiere que el investigador examine la capacidad de múltiples factores, derivados de la historia y el examen clínico para predecir un resultado de interés. El resultado de interés sirve como la referencia estándar o "Gold Standard" por el cual se considera un éxito el tratamiento. Todos los posibles factores que se puedan creer relacionados con el resultado de interés, deberán ser incluidos como potenciales factores predictivos. Estos factores predictivos pueden ser seleccionados desde la literatura, por la experiencia previa experimentada en el trabajo, o bien desde la experiencia de investigadores clínicos. Una vez que se establecen las variables predictoras, los sujetos son expuestos al tratamiento de interés, posteriormente son evaluados según si el resultado es éxito o, por el contrario, no éxito, comparándolo con el estándar de referencia, basado éste en la puntuación predeterminada de corte, y que es clínicamente relevante. Aunque otras técnicas podrían ser útiles, la regresión logística, es el elemento estadístico comúnmente utilizado para la determinación de las variables predictivas de mayor potencia, y para maximizar la fiabilidad de este valor predictivo.[170,171]

La RPC ha demostrado un gran potencial para obtener relevancia clínica dentro de la práctica, siendo una herramienta que está basada en la evidencia, y sirve a los clínicos en la identificación de subgrupos relevantes de pacientes. Sin la capacidad de asociar determinadas intervenciones a determinados grupos de pacientes, los clínicos no tendrán un aporte basado en la evidencia, en su proceso de toma de decisiones. El desarrollo de una RPC para predecir de forma efectiva, que pacientes experimentarán una mayor mejora clínica en el dolor y la función a través de la manipulación de columna cervical, charnela cérvico-dorsal y columna dorsal, puede ser en sí misma bastante útil para los terapeutas en el proceso de toma de decisiones. Si los pacientes que se benefician de las manipulaciones, pueden ser identificados de manera sencilla a través de la historia y el examen físico, los fisioterapeutas podrán utilizar las manipulaciones de columna cervical, charnela cérvico-dorsal y columna dorsal con una mayor probabilidad de éxito en este tipo de pacientes. El criterio de la RPC puede ser utilizado en el futuro en ensayos clínicos, mejorando así la capacidad de las investigaciones clínicas, durante los estudios que valoren la respuesta de los pacientes con dolor cervical. Por lo tanto, uno de los objetivos principales de este trabajo de tesis doctoral consiste en la propuesta una RPC para identificar pacientes con dolor cervical sean capaces de experimentar una mejora sustancial en un periodo corto de tiempo.

5.1 Manipulación espinal de la columna cervical y de la charnela Cérvico-dorsal.

La Guía para la Práctica de la Fisioterapia,[57] identifica, que la manipulación y la movilización son intervenciones apropiadas para el tratamiento de los pacientes con alteraciones de la columna vertebral, y evidencian que diferentes ensayos clínicos randomizados y revisiones sistemáticas, garantizan la efectividad de esta intervención para pacientes con dolor cervical.[30,51,67,70,71,175,176]

Varios estudios han demostrado la eficacia de la manipulación cervical[59,64,68] y torácica[62,63] para el tratamiento del dolor cervical; existiendo controversia en relación a la efectividad con respecto a la utilización de otras técnicas de fisioterapia[57]. Estos desacuerdos pueden ser atribuidos a la heterogeneidad del dolor mecánico cervical, por lo que en la práctica clínica no todos los pacientes se pueden beneficiar de la misma intervención terapéutica. [65]

6. Vendaje Neuromuscular con KinesioTaping ®

Algunos pacientes no pueden recibir procedimientos basados en la manipulación vertebral de alta velocidad por presentar alguna de las contraindicaciones que estas tienen, por lo que es importante el tener alternativas terapéuticas que puedan ser aplicadas en estos pacientes con dolor cervical, y que no conlleven riesgo potencial para su salud.

Una técnica que está en auge y muy utilizada en los últimos tiempos por la fisioterapia para el tratamiento del dolor es el KinesioTaping ®, siendo el campo de las lesiones deportivas donde está teniendo un mayor éxito de aplicación.[177] Dentro de los beneficios obtenidos se encuentran la mejora del dolor, disminución o aumento del tono muscular, mejora del sistema linfático y arterio-venoso, todo ello en función de la forma de aplicación.[177-182] El KinesioTaping ® es una técnica desarrollada en los años 70, compuesta por un material adhesivo flexible y que se diferencia de la cinta clásica en sus características físicas. Es muy fino y puede ser estirado hasta el 120-140 % de su original[182] longitud que lo hace más elástico que la cinta convencional.

Es cierto que su eficacia no esta muy estudiada desde el punto de vista científico. Unos artículos publicados nos proporcionan pruebas preliminares de que el Kinesio Taping ® puede ser beneficioso en el tratamiento del dolor agudo de la rótula,[180] tobillo,[179] tronco,[178] y dolor miofascial.[183] Más recientemente ensayos clínicos aleatorios han demostrado que el Kinesio Taping ® puede ser eficaz para el tratamiento de hombro[184] y el latigazo cervical[185] mejorando el rango de movimiento y el dolor. En pacientes con dolor de hombro, el Kinesio Taping ® mejoró inmediatamente el rango de movimiento activo, pero no hubo cambios en el dolor.[184] Sin embargo, hasta el momento ningún estudio evaluó los efectos del Kinesio Taping ® en pacientes con el dolor mecánico cervical.

7. Planteamiento del Problema.

La cervicalgia crónica de origen mecánico es un problema de salud altamente prevalente en nuestra sociedad cuyo coste sociosanitario no es asumible en la actual situación económica. El paciente con cervicalgia crónica sufre un proceso autolimitado de discapacidad y pérdida de función que le anima a la demanda de cuidados por parte del fisioterapeuta para favorecer la rápida reincorporación laboral, así como, la eliminación de los síntomas para una mejora de su calidad de vida.

La fisioterapia presenta un amplio arsenal terapéutico frente a la cervicalgia crónica que ha sido utilizado sin el adecuado refrendo de la investigación, empleando a veces diferentes procedimientos para aliviar los síntomas sin conocer realmente la supremacía de uno sobre otros, o la especificidad terapéutica ante determinado tipo de pacientes.

Las nuevas tendencias en la Fisioterapia necesitan de la aparición de estudios que puedan manifestar las posibles diferencias entre distintos procedimientos terapéuticos como la manipulación espinal o el Kinesio Taping. La evolución de una disciplina joven como la fisioterapia exige de la puesta en marcha de estudios de efectividad interna en aquellos casos donde el procedimiento haya sido implantado de forma empírica en la práctica clínica, como es el caso del kinesio Taping. En el caso de procedimientos de amplia trayectoria como la manipulación espinal, se hacen necesarios estudios de eficacia comparativa con el objeto de dilucidar cual es el procedimiento con mayor potencia terapéutica ante un problema de salud específico como la cervicalgia mecánica crónica. Finalmente, el desarrollo de una RPC sobre manipulación espinal puede facilitar la labor del fisioterapeuta asumiendo el uso de este procedimiento en aquellos pacientes especialmente proclives a mejorar con esta maniobra terapéutica, de forma que la fisioterapia pueda optimizar su capacidad y reducir su ineficacia, especialmente en patologías de un alto interés social como la cervicalgia crónica.

BIBLIOGRAFIA.

1.- Anita Gross, Jordan Miller, Jonathan D'Sylva, Stephen J Burnie, Charles H Goldsmith, Nadine Graham, Ted Haines, Gert Brønfort, Jan L Hoving. Manipulación o movilización para el dolor de cuello (Revision Cochrane traducida). En: *Biblioteca Cochrane Plus* 2010 Número 1. Oxford: Update Software Ltd. Disponible en: http://www.update-software.com. (Traducida de *The Cochrane Library*, 2010 Issue 1 Art no. CD004249. Chichester, UK: John Wiley & Sons, Ltd.).

2. Jull G. Classification systems in clinical practice. Phys Res Inter 2004;9(4):3-4.

3. Medina i Mirapeix F, Saturno Hernández P, Montilla Herrador J, Valera Garrido JF, Escolar Reina P, Meseguer Henarejos AB. Variabilidad en la valoración del paciente con cervialgia mecánica en fisioterapia. Un estudio usando protocolos. Fisioterapia 2007;29(4):190-5.

4. Pérez Cabezas V. La fisioterapia en la cervicalgia. Eficacia de un programa de reeducación óculo-cervical (Tesis Doctoral). Universidad de Sevilla, 2011.

5. González Iglesias J, Efectos de la fisioterapia manipulativa articular del raquis dorsal en pacientes con cervicalgia mecánica (Tesis Doctoral). Universidad de Oviedo, 2009.

6. Travernier C, Maifelleter JF, Pirota C. Diagnostic et traitement des cervicalgies. Encycl. Méd. Chir. Apareil Locomoteur, 14-365-A-10. Paris-France: Elsevier; 1996. p. 14.

7. Côté P, Cassidy D, Carroll L. The Saskatchewan health and back pain survey. The prevalence of neck pain and related disability in Saskatchewan adults. Spine 1998; 23:1689-98.

8. Paz J, Belmonte MA. Monografías médico-quirúrgicas del aparato locomotor. Cervicobraquialgia. Barcelona: Masson; 2000.

9. Travel JG, Simons DG. Myofascial pain and dysfunction. The trigger point manual. Baltimore: Willians Wilkins; 1983.

10. Bot SD, Van der Waal JM, Terwee CB, van der Windt DA, Scholten RJ, Bouter LM, Dekker J. Predictors or outcome in neck and shoulder symptoms: a cohort study in general practice. Spine 2005;30:E450-E470.

11. Kogler A, Lindfors J, Odkvist LM, Ledin T. Postural stability using different neck positions in normal subjects and patients with neck trauma. Acta Otolaryngol 2000; 120; 151-155.

12. Madeleine P, Prietzel H, Svarrer H, Arendt-Nielsen L. Quantitative posturography in altered sensory conditions a way to asses balance instability in patients with chronic whiplash injury. Arch PhysMed Rehabil 2004;85:432-438.

13. Apsit E. La reeducación des cervicalgies. Encycl. Méd. Chir. Kinésithérapie, 26,294-C-10. Paris-France: Elsevier;1989. p. 18.

14. Ohlsson K, Attewell R, Paisson B, Karlsson B, Johnsson B, Ahlm A, Skerfving S. Repetitive industrial work and neck an apper limb disorders in females. Am K Ind Med 1995;27:731-47.

15. Kilbom A, Persson J, Jonsson BG. Dissorders of the cervicobrachial region among female workers in the electronics industry. Int J Ind Ergo 1986;1:37-47.

16. Barry M, Jenner JR. ABC of Rheumatology. Pain in neck, shoulder and arm. BMJ 1995;310:183-186.

17. Veisterd KG, Wesgaard RH. Subjectively assessed occupational and individual parameters as risk factors for trapezius myalgia. Int J Ind Ergonomics 1994;13:235-45.

18. Aaras A. Relationship between trapezius load and the incidence of musculoskeletal illness in the neck and shoulder. Int J Ind Ergonomics 1994;14:341-48.

19. Saavedra-Hernández M, Castro-Sánchez AM, Fernández-de-las-Peñas C, Cleland JA, Ortega-Santiago R, Arroyo-Morales M. Predictors for identifying patients with mechanical neck pain who are likely to achieve short-term success with manipulative interventions directed at the cervical and thoracic spine. J Manipulative Physiol Ther 2011;34:144-152.

20. Fejer R, Ohm-Kyvik K, Hartvigsen J. The prevalence of neck pain in the world population: a systematic critical review of the literature. Eur Spine J 2006; 15: 834-48.

21. Walker B. The prevalence of low back pain: a systematic of the literature from 1996 to 1998. J Spinal Disord 2000; 13: 205-17.

22. Côté P, Cassidy J, Carroll L. The factors associated with neck pain and its related disability in the Saskatchewan population. Spine 2000;25:1109-17

23. Rempel DM, Harrison RJ, Barnhart S. Work-related cumulative trauma disorders of the upper extremity. JAMA 1992;267:838-42.

24. Nygren A, Berglund A, von Koch M. Neck-and-shoulder pain, an increasing problem. Strategies for using insurance material to follow trends. Scand J Rehabil Med Suppl 1995; 32:107-12.

25. Makela M, Heliovaara M, Sievers K, Impivaara O, Knekt P, Aromaa A. Prevalence, determinants, and consequences of chronic neck pain in Finland. Am J Epidomiol 1991;134:1356-67.

26. Brattberg G, Thorslund M, Wikman A. The prevalence of pain in a general population. The results of a postal survey in a county of Sweden. Pain 1989;37:215-22.

27. Andersson HI, Ejlertsson G, Leden I, Rosenberg C. Chronic pain in a geographically defined general population: studies of differences in age, gender, social class, and pain localization. Clin J Pain 1993;9:174-82.

28. Bovim G, Schrader H, Sand T. Neck pain in the general population. Spine 1994;19(12):1307-9.

29. Borghouts JA, Koes BW, Vondeling H, Bouter LM. Cost-of-illnes of neck pain in The Netherlands in 1996. Pain 1999; 80:629-36.

30. Borghouts JA, Koes BW, Bouter LM. The clinical course and prognostic factors of non-specific neck pain: a systematic review. Pain 1998;77:1-13.

31. Korthals-de BI, Hoving JL, van Tulder MW, Rutten-van Mölken MP, Adèr HJ, de Vet HC, Koes BW, Vondeling H, Bouter LM. Cost effectiveness of physiotherapy, manual therapy, and general practitioner care for neck pain: economic evaluation alongside a randomized controlled trial. BMJ 2003; 326 (7395):911.

32. Bunketorp L, Stener-Victorin E, Carlsson J. Neck pain and disability following motor vehicle accidents-a cohort study. Eur Spine J 2005;14:84-89.

33. Luime JJ, Koes BW, Miedem HS, Verhaar JA, Burdorf A. High incidence and recurrence of shoulder and neck pain in nursing home employees was demonstrated during a 2-year follow-up. J Clin Epidemiol 2005;58:407-413.

34. Côté P, Cassidy JD, Carroll LJ, Kristman V. The annual incidence and course of neck pain in the general population: a population based cohort study. Pain 2004;112:267-273.

35. Edwads RHT. Hypotheses of peripheral and central mechanisms underlying occupational muscle pain and injury. Eur J Appl Physiol 1988;57:275-281.

36. Wright A, Mayer T, Gatchel R. Outcomes of disabling cervical spine disorders in compensation injuries. A propective comparison to tertiary rehabilitation response for chronic lumbar disorders. Spine 1999;24:178-183.

37. Díez V, Bonilla R, Conde C. Unidades de fisioterapia. Área 1 de atención primaria en Madrid. Madrid; 1996.

38. Waalen D, White P, Waalen J. Demographic and clinical characteristics of chiropractic patients: a 5-year study of patients treated at the Canadian Memorial Chiropratic Collage. J Can Chiropract Assoc 1994;38:75-82.

39. Hacket GI, Hudson MF, Wylie JB. Evaluation of the efficacy and acceptability to patients of a physiotherapist working in a health centre. BMJ 1987; 294:24-26.

40. Gore DR, Sepic SB, Gardner GM, Murray MP. Neck pain: a long-term follow-up of 205 patients. Spine 1987;12:1-5.

41. Bunketorp L, Nordholm L, Carlsson J. A descriptive analysis of disorders in patients 17 years following motor vehicle accidents. Eur Spine J 2002;11:227-234.

42. Hill J, Lewis M, Papageorgiou AC, Dziedzic K, Croft P. Predicting persistent neck pain: a 1-year follow-up of population cohort. Spine 2004;29:1648-1654.

43. Jette AM, Smith K, Haley SM, Davis KD. Physical therapy episodes of care for patients with low back pain. Phys Tjer 1994;74:101-110.

44. Lamberts H, Brouwer H, Groen AJM, Huisman H. Het transitiemodel in the huisartspraktijk. Hjuisart Wet 2007;30:105-13.

45. Suñol R, Carbonell JM, Nualart L, Colomes L, Guix J, Bañeres J, et al. Hacia la integridad asistencial: propuesta de un modelo basado en la evidencia y sistema de gestión. Med Clin (Barc) 1999; 112(suppl):97-105.

46. Vázquez D. Cervicalgia crónica y ejercicio. Rehabilitación 2003;37:333-338.

47. Côté P, van der Velde G, Cassidy JD, Carroll LJ, Hogg-Johnson S, Holm LW et al. The burden and determinants of neck pain in workers. Results of the Bone and Joint 2000-2010 Task force on Neck Pain and Its Associated Disorders. Spine 2008;33(Suppl):S60-S74.

48. Hartling L, Brison RJ, Ardern C, Pickett W. Prognostic value of the Quebec classification of Whiplash-associated disorders. Spine 2001;26:36-41.

49. Holm LW, Carroll LJ, Cassidy JD, Hogg-Johnson S, Côté P, Guzman J, et al. The burden and determinants of neck pain in whiplash-associated disorders after traffic collisions: results of the Bone and Jont decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. Spine 2008;33(Suppl):S52-S59.

50. Fisk JW. A Practical Guide to Management of Painful Back and Neck: Diagnosis, Manipulation, Exercises, Prevention. New York, NY: Charles C Thomas Books; 1995.

51. Aker PD, Gross AR, Goldsmith CH, Peloso P. Conservative management of mechanical neck pain: systematic overview and meta-analysis. BMJ. 1996;313:1291–1296.

52. Québec Task Force on Spinal Disorders. Scientific approach to the assessment and management of activity-related spinal disorders: a monograph for clinicians. Spine. 1987;12:51–59.

53. Clinical Evidence: A Compendium of the Best Available Evidence for Effective Health Care. London, England: BMJ Publishing Group; 2000 (issue 4). Available at: www.clinicalevidence.org.

54. Nachemson A, Jonsson E, Carlsson CA, Englund L, Goossens M, van Tulder M, et al. Back and Neck pain. Stockholm. The Swedish Council on Technology Assessment

in Health Care (SBU). The National Coordinating centre for Health Technology Assessment (NCCHTA). Report Nº 145, 2000;417(I):1-28.

55. Hoving JL, Gross A, Gassner D, Kay T, Kennedy C, Hondras M, et al. A critical appraisal of review articles on the effectiveness of conservative treatment for neck pain. Spine 2001;26:196-205.

56. Albright J, Allman R, Bonfiglio RP, Conill A, Dobkin B, Guccione AA, et al. Philadelphia Panel Evidence-Based Guidelines on Selected Rehabilitation Interventions for Neck Pain. Phys Ther 2001;81:1701-17.

57. American Physical Therapy Association (APTA). Guide to Physical Therapy Practice. 2nd ed. ed.APTA, 2001.

58. Hurley L, Yardley K, Gross AR, Hendry L, McLaughlin L. A survey to examine attitudes and patterns of practice of physiotherapists who perform cervical spine manipulation. Man Ther 2002;7:10-8.

59. Evans R, Bronfort G, Nelson B, Goldsmith CH. Two-year follow-up of a randomized clinical trial of spinal manipulation and two types of exercise for patients with chronic neck pain. Spine 2002;27:2383-9.

60. Bronfort G, Evans R, Nelson B, Aker PD, Goldsmith CH, Vernon H. A randomized clinical trial of exercise and spinal manipulation for patients with chronic neck pain. Spine 2001;26:788-97.

61. Jull G, Trott P, Potter H, Cito G. A randomized controlled trial of exercise and manipulative therapy for cervicogenic headache. Spine 2002;27:1835-43.

62. González-Iglesias J, Fernández-de-las Peñas C, Cleland J, Gutiérrez-Vega M. Thoracic spine manipulation for the management of patients with neck pain: A randomized clinical trial. J Orthop Sports Phys Ther 2009a; 39: 20-27.

63. González-Iglesias J, Fernández-de-las-Peñas C, Cleland JA, Alburquerque-Sendín F, Palomeque-del-Cerro L, Méndez-Sánchez R. Inclusion of thoracic thrust

manipulation into an electrotherapy program for the management of patients with acute mechanical neck pain: A randomized clinical trial. Man Ther 2009b; 14: 306-313.

64. Martínez-Segura R, Fernández-de-las-Peñas C, Ruiz-Sáez M, López-Jiménez C, Rodríguez-Blanco C. Immediate effects on neck pain and active range of motion following a single cervical HVLA manipulation in subjects presenting with mechanical neck pain: A randomized controlled trial. J Man Physiol Ther 2006; 29: 511-7.

65. Fernández-de-las-Peñas C, Cleland JA, Glynn P. Spinal manipulative therapy: from research to clinical practice. Crit Rev Phys Rehabil Med 2008a; 20 : 39-53.

66. Bronfort G, Haas M, Evans RL, Bouter LM. Efficacy of spinal manipulation and mobilization for low back pain and neck pain: a systematic review and best evidence synthesis. Spine 2004;4:335-56.

67. Gross AR, Hoving JL, Haines TA, Goldsmith CH, Kay T, Aker P, et al. A Cochrane review of manipulation and mobilization for mechanical neck disorders. Spine 2004;29:1541-8.

68. Bronfort G, Assendelft WJ, Evans R, Haas M, Bouter L. Efficacy of spinal manipulation for chronic headache: a systematic review. J Manipulative Physiol Ther 2001;24:457-66.

69. Saturno PJ, Medina F, Valera F, Montilla J, Escolar P, Gascón JJ. Validity and reliability of guidelines for neck pain treatment in primary health care. A nationwide empirical analysis in Spain. Int J Qual Health Care 2003;15:487-93.

70. Hurwitz EL, Aker PD, Adams AH, Meeker WC, Shekelle PG . Manipulation and mobilization of the cervical spine. A systematic review of the literature. Spine 1996;21:1746-59.

71. Di Fabio RP. Manipulation of the cervical spine: risks and benefits. Phys Ther 1999;79:50-65.

72. Haldeman S, Kohlbeck FJ, McGregor M. Unpredictability of cerebrovascular ischemia associated with cervical spine manipulation therapy: a review of sixty-four cases after cervical spine manipulation. Spine 2002;27:49-55.

73. Bolton PS, Stick PE, Lord RS. Failure of clinical tests to predict cerebral ischemia before neck manipulation. J Manipulative Physiol Ther 1989;12:304-7.

74. Cote P, Kreitz BG, Cassidy JD, Thiel H . The validity of the extension-rotation test as a clinical screening procedure before neck manipulation: a secondary analysis. J Manipulative Physiol Ther 1996;19:159-64.

75. Haldeman S, Kohlbeck F, McGregor M. Risk factors and precipitating neck movements causing vertebrobasilar artery dissection after cervical trauma and spinal manipulation. Spine 1999;24:785-94.

76. Haldeman S, Carey P, Townsend M. Arterial dissections following cervical manipulation: the chiropractic experience. CMAJ 2001;165:905-6.

77. Piva S, Erhard R, Al-Hugail M. Cervical radiculopathy: A case problem using a decision-making algorithm. J Orthop Sports Phys Ther 2000;30:745-54.

78. Childs JD, Fritz JM, Piva SR. Proposal of a classification system for patients with neck pain. J Orthop Sports Phys Ther 2004;34:686-96.

79. Childs JD, Whitman JM, Fritz JM. The Lower Cervical Spine. Physical Therapy for the Cervical Spine and Temporomandibular Joint. La Crosse, WI: Orthopaedic Section of the American Physical Therapy Association, Inc., 2003:8-63.

80. Greenman P. Principles of Manual Medicine. 2nd ed. Philadelphia, PA: Lippincott Williams and Wilkins, 1996.

81. Norlander S, ste-Norlander U, Nordgren B. Mobility in the cervicothoracic motion segment: an indicative factor of musculo-skeletal neckshoulder pain. Scand J Rehabil Med 1996;28:183-92.

82. Norlander S, Gustavsson BA, Lindell J. Reduced mobility in the cervico-thoracic motion segment--a risk factor for musculoskeletal neckshoulder pain: a two-year prospective follow-up study. Scand J Rehabil Med 1997;29:167-74.

83. Norlander S, Nordgren B. Clinical symptoms related to musculoskeletal neck-shoulder pain and mobility in the cervico-thoracic spine. Scand J Rehabil Med 1998;30:243-51.

84. Paungmali A, O'Leary S, Souvlis T. Naloxone fails to antagonize initial hypoalgesic effect of a manual therapy treatment for lateral epicondylalgia. J Manipulative Physiol Ther 2004;27:180-5.

85. Vicenzino B, Collins D, Benson H. An investigation of the interrelationship between manipulative therapy-induced hypoalgesia and sympathoexcitation. J Manipulative Physiol Ther 1998;21:448-53.

86. Flynn TW, Wainner RS, Whitman JM. Immediate effects of thoracic spine manipulation on cervical range of motion and pain. J Man Manipulative Ther 2001;9(3): 164-171.

87. Cleland JA, Childs JD, McRae M. Immediate effects of thoracic manipulation in patients with neck pain: a randomized clinical trial. Man Ther 2005;10:127-35.

88. Erhard RE, Piva SR. Manipulation Therapy. In: Placzek JD, Boyce DA, eds. Orthopaedic Physical Therapy Secrets. Philadelphia, PA: Hanley & Belfus, 2000:83-91.

89. Panjabi MM. The stabilizing system of the spine. Part II. Neutral zone and instability hypothesis. J Spinal Disord 1992;5:390-6.

90. Panjabi MM. The stabilizing system of the spine. Part I. Function, dysfunction, adaptation, and enhancement. J Spinal Disord 1992;5:383-9.

91. Panjabi MM, Oxland TR, Parks EH. Quantitative anatomy of cervical spine ligaments. Part II. Middle and lower cervical spine. J Spinal Disord 1991;4:277-85.

92. Panjabi MM, Oxland TR, Parks EH. Quantitative anatomy of cervical spine ligaments. Part I. Upper cervical spine. J Spinal Disord 1991;4:270-6.

93. Aprill C, Bogduk N. The prevalence of cervical zygapophyseal joint pain. A first approximation. Spine 1992;17:744-7.

94. Barnsley L, Lord S, Wallis B. False-positive rates of cervical zygapophyseal joint blocks. Clin J Pain 1993;9:124-30.

95. Bogduk N, Windsor M, Inglis A. The innervation of the cervical intervertebral discs. Spine 1988;13:2-8.

96. Mercer SR, Bogduk N. Joints of the cervical vertebral column. J Orthop Sports Phys Ther 2001;31:174-82.

97. Mercer S, Bogduk N. The ligaments and annulus fibrosus of human adult cervical intervertebral discs. Spine 1999;24:619-26.

98. Mercer S, Bogduk N. Intra-articular inclusions of the cervical synovial joints. Br J Rheumatol 1993;32:705-10.

99. Schwartzer A, Wang S, Bogduk N. Prevalence and clinical features of lumbar zygapophyseal joint pain: a study in an Australian population with chronic low back pain. Ann Rheum Dis 1995;54:100-6.

100. Harms-Ringdahl K, Ekholm J. Intensity and character of pain and muscular activity levels elicited by maintained extreme flexion position of the lower-cervical-upper-thoracic spine. Scand J Rehabil Med 1986;18:117-26.

101. Derrick L, Chesworth B. Post-motor vehicle accident alar ligament instability. J Orthop Sports Phys Ther 1992;16:6-10.

102. Clair D, Edmondston S, Allison G. Variability in pain intensity, physical and psychological function in non-acute, non-traumatic neck pain. Physiotherapy Research International 2004;9:43-54.

103. Jordan A, Bendix T, Nielsen H, Hansen FR, Høst D, Winkel A. Intensive training, physiotherapy, or manipulation for patients with chronic neck pain. A prospective, singleblinded, randomized clinical trial. Spine 1998;23:311-8.

104. Hoving JL, Gross AR, Gasner D. A critical appraisal of review articles on the effectiveness of conservative treatment for neck pain. Spine 2001;26:196-205.

105. Pho C, Godges J. Management of whiplash-associated disorder addressing thoracic and cervical spine impairments: a case report. J Orthop Sports Phys Ther 2004;34:511-9.

106. Parkin-Smith GF, Penter CS. A clinical trial investigating the effect of two manipulative approaches in the treatment of mechanical neck pain: A pilot study. J Neuromusculoskel Sys 1998;6:6-15.

107. Fernandez-de-las-Penas C, Fernandez-Carnero J, Fernandez AP. Dorsal Manipulation in Whiplas Injury Treatment: A Randomized Controlled Trial. J Whiplash Rel Dis 2004;3:55-72.

108. Adams G, Sim J. A survey of UK manual therapists' practice of and attitudes towards manipulation and its complications. Physiother Res Int 1998;3:206-27.

109. Griegel-Morris P, Larson K, Mueller-Klaus K. Incidence of common postural abnormalities in the cervical, shoulder, and thoracic regions and their association with pain in two age groups of healthy subjects. Phys Ther 1992;72:425-31.

110. Arana E, Marti-Bonmati L, Molla E. Upper thoracic-spine disc degeneration in patients with cervical pain. Skeletal Radiol 2004;33:29-33.

111. Giles LG, Taylor JR. Human zygapophyseal joint capsule and synovial fold innervation. Br J Rheumatol 1987;26:93-8.

112. Evans DW. Mechanisms and effects of spinal high-velocity, low-amplitude thrust manipulation: previous theories. J Manipulative Physiol Ther 2002;25:251-62.

113. Boyle JJ, Singer KP, Milne N. Morphological survey of the cervicothoracic junctional region. Spine 1996;21:544-8.

114. Boyle JJ, Milne N, Singer KP. Influence of age on cervicothoracic spinal curvature: an ex vivo radiographic survey. Clin Biomech 2002;17:361-7.

115. Edmondston S, Breidahl WH, Singer KP. Segmental trends in cancellous bone structure in the thoracolumbar spine: histological and radiological comparisons. Australasian Radiol 1994;38:272-7.

116. Edmondston SJ, Singer KP. Thoracic spine: anatomical and biomechanical considerations for manual therapy. Man Ther 1997;2:132-43.

117. Stagnara P, De Mauroy JC, Dran G. Reciprocal angulation of vertebral bodies in a sagittal plane: approach to references for the evaluation of kyphosis and lordosis. Spine 1982;7:335-42.

118. Maitland G, Hengeveld E, Banks K. Maitland's Vertebral Manipulation. 6th ed. Oxford: Butterworth- Heinemann, 2000.

119. Flynn TW. Current Concepts of Orthopaedic Physical Therapy: Thoracic Spine and Chest Wall. La Crosse: Orthopaedic Section, American Physical Therapy Association, 2001.

120. Dwyer A. Cervical zygapophyseal joint pain patterns. I: A study in normal volunteers. Spine 1990;15:453-7.

121. McLain RF. Mechanoreceptor endings in human cervical facet joints. Iowa Orthop J 1993;13:149-54.

122. McLain RF, Pickar JG. Mechanoreceptor endings in human thoracic and lumbar facet joints. Spine 1998;23:168-73.

123. Pickar JG. Neurophysiological effects of spinal manipulation. Spine 2002;2:357-71.

124. Sterling M, Jull G, Wright A. Cervical mobilisation: concurrent effects on pain, sympathetic nervous system activity and motor activity. Man Ther 2001;6:72-81.

125. Cleland J, Durall C, Scott S. Effects of slump long sitting on peripheral sudomotor and vasomotor function: A pilot study. J Man Manipulative Ther 2002;10:67-75.

126. McLean S, Naish R, Reed L. A pilot study of the manual force levels required to produce manipulation induced hypoalgesia. Clin Biomech 2002;17:304-8.

127. McGuiness J, Vicenzino B, Wright A. Influence of a cervical mobilization technique on respiratory and cardiovascular function. Man Ther 1997;2:216-20.

128. Skyba DA, Radhakrishnan R, Rohlwing JJ. Joint manipulation reduces hyperalgesia by activation of monoamine receptors but not opioid or GABA receptors in the spinal cord. Pain 2003;106:159-68.

129. Skyba DA, Radhakrishnan R, Sluka KA. Characterization of a method for measuring primary hyperalgesia of deep somatic tissue. J Pain 2005;6:41-7.

130. Vicenzino B, Cartwright T, Collins D, Sahlstedt B. An investigation of stress and pain perception during manual therapy in asymptomatic subjects. Eur J Pain 1999;3:13-8.

131. McKenzie RA. Cervical and Thoracic Spine: Mechanical Diagnosis and Therapy. Minneapolis: Orthopaedic Physical Therapy Products, 1990.

132. Janda V. Muscles, central nervous system motor regulation and back problems. In: Korr IM, ed. The Neurobiologic Mechanisms in Manipulative Therapy. New York: Plenum Press, 1978:27-40.

133. Suter E, Herzog W, Conway PJ. Reflex responses associated with manipulative treatment of the thoracic spine. J Neuromusculoskel Sys 1994;2:124-30.

134. Herzog W, Conway PJ, Zhang YT. Reflex responses associated with manipulative treatments on the thoracic spine: a pilot study. J Manipulative Physiol Ther 1995;18:233-6.

135. Straker L, Briggs A, Greig A. The effect of individually adjusted workstations on upper quadrant posture and muscle activity in school children. Work 2002;18:239-48.

136. Janda V. Evaluation of muscular imbalance. In: Liebenson C, ed. Rehabilitation of the Spine: A Practitioner's Manual. Baltimore: Williams and Wilkins. p. 97-112.

137. Raine S, Twomey L. Attributes and qualities of human posture and their relationship to dysfucntion or musculoskeletal pain. Clin Rev Phys Rehabil Med 1994;6:409-37.

138. Stokes M, Young A. The contribution of reflex inhibition to arthrogenous muscle weakness. Clin Sci (Lond) 1984;67:7-14.

139. Hurley MV, Jones DW, Newham DJ. Arthrogenic quadriceps inhibition and rehabilitation of patients with extensive traumatic knee injuries. Clin Sci (Lond) 1994;86:305-10.

140. Suter E, McMorland G, Herzog W. Decrease in quadriceps inhibition after sacroiliac joint manipulation in patients with anterior knee pain. J Manipulative Physiol Ther 1999;22:149-53.

141. Suter E, McMorland G, Herzog W. Conservative lower back treatment reduces inhibition in knee-extensor muscles: a randomized controlled trial. J Manipulative Physiol Ther 2000;23:76-80.

142. Suter E, McMorland G. Decrease in elbow flexor inhibition after cervical spine manipulation in patients with chronic neck pain. Clin Biomech 2002;17:541-4.

143. Hides JA, Stokes MJ, Saide M. Evidence of lumbar multifidus muscle wasting ipsilateral to symptoms in patients with acute/subacute low back pain. Spine 1994;19:165-72.

144. Hodges PW, Richardson CA. Inefficient muscular stabilization of the lumbar spine associated with low back pain. A motor control evaluation of transversus abdominis. Spine 1996;21:2640-50.

145. Grabiner MD, Koh TJ. Decoupling of bilateral paraspinal excitation in subjects with low back pain. Spine 1992;17:1219-23.

146. Hurley MV, Newham DJ. The influence of arthrogenous muscle inhibition on quadriceps rehabilitation of patients with early, unilateral osteoarthritic knees. Br J Rheumatol 1993;32:127-31.

147. Cibulka MT, Rose SJ, Delitto A. Hamstring muscle strain treated by mobilizing the sacroiliac joint. Phys Ther 1986;66:1220-3.

148. Herzog W, Scheele D, Conway PJ. Electromyographic responses of back and limb muscles associated with spinal manipulative therapy. Spine 1999;24:146-52.

149. Cleland J, Selleck B, Stowell T. Short-term Effect of Thoracic Manipulation on Lower Trapezius Muscle Strength. J Man Manipulative Ther 2004;12:82-90.

150. Liebler EJ, Tufano-Coors L. The effect of thoracic spine mobilization on lower trapezius strength testing. J Man Manipulative Ther 2001;9:207-12.

151. Yerys S, Makofsky H, Byrd C. Effects of mobilizarion of the anterior hip capsulae on gluteus maximus strength. J Man Manipulative Ther 2002;10:218-24.

152. Shambaugh GE, Jr. Manipulating medicine. Lancet 1995;345:1574.

153. Johansson H, Sojka P. Pathophysiological mechanisms involved in genesis and spread of muscular tension in occupational muscle pain and in chronic musculoskeletal pain syndromes: a hypothesis. Med Hypotheses 1991;35:196-203.

154. Cleland JA. Orthopaedic clinical examination: An evidence-based approach for physical therapists. 1st ed. Carlstadt: Icon Learning Systems, 2005.

155. Lee H, Nicholson LL, Adams RD. Cervical range of motion associations with subclinical neck pain. Spine 2004;29:33-40.

156. Lee H, Nicholoson LL, Adams RD. Body chart pain location and sidespecific physical impairment in subclinical neck pain. J Manipulative Physiol Ther 2005;28:479-86.

157. Lee H, Nicholson LL, Adams RD. Neck muscle endurance, self-report, and range of motion data from subjects with treated and untreated neck pain. J Manipulative Physiol Ther *2*005;28:25-32.

158. Jull G, Kristjansson E, Dall'Alba P. Impairment in the cervical flexors: a comparison of whiplash and insidious onset neck pain patients. Man Ther 2004;9:89-94.

159. Jull G. Deep cervical flexor muscle dysfunction in whiplash. J Musculoskel Pain 2000;8.5:143-54.

160. Jull GA, Richardson CA. Motor control problems in patients with spinal pain: a new direction for therapeutic exercise. J Manipulative Physiol Ther 2000;23:115-7.

161. Ylinen J, Salo P, Nykanen M et al. Decreased isometric neck strength in women with chronic neck pain and the repeatability of neck strength measurements. Arch Phys Med Rehabil 2004;85:1303-8.

162. Falla D. Unravelling the complexity of muscle impairment in chronic neck pain. Man Ther 2004;9:125-33.

163. Falla DL, Jull GA, Hodges PW. Patients with neck pain demonstrate reduced electromyographic activity of the deep cervical flexor muscles during performance of the craniocervical flexion test. Spine 2004;29:2108-14.

164. Dvorak J, Froehlich D, Penning L. Functional radiographic diagnosis of the cervical spine: flexion/extension. Spine 1988;13:748-55.

165. Dvorak J, Penning L, Hayek J, Panjabi MM, Grob D, Zehnder R. Functional diagnostics of the cervical spine using computer tomography. Neuroradiology 1988;30:132-7.

166. Panjabi MM, Abumi K, Duranceau J, Oxland T. Spinal stability and intersegmental muscle forces. A biomechanical model. Spine 1989;14:194-9.

167. Panjabi MM, Crisco JJ, Vasavada A, Oda T, Cholewicki J, Nibu K, et al. Mechanical properties of the human cervical spine as shown by three-dimensional load-displacement curves. Spine 2001;26:2692-700.

168. Brosseau L, Tugwell P, Wells GA. Philadelphia Panel Evidence-Based Clinical Practice Guidelines on Selected Rehabilitation Interventions for Neck Pain. Phys Ther 2001;81:1701-17.

169. Hayward R, Wilson M, Tunis S, Eric BB, Gordon G. Users' guide to the medical literature. VIII. How to use clinical practice guidelines. A. Are the recommendations valid? JAMA 1995;274:570-4.

170. Laupacis A, Sekar N, Stiell IG. Clinical prediction rules. A review and suggested modifications and methodological standards. JAMA 1997;277:488-94.

171. McGinn T, Guyatt G, Wyer P, Naylor CD, Stiell IG, Richardson WS. Users' guides to the medical literature XXII: How to use articles about clinical decision rules. JAMA 2000;284:79-84.

172. Stiell IG, McKnight RD, Greenberg G. Implementation of the Ottawa ankle rules. JAMA 1994;271:827-32.

173. Mark D, Shaw L, Harrell F, Sean RT, Eric BB. Prognostic value of a treadmill exercise score in outpatients with suspected coronary artery disease. N Engl J Med 1991;325:849-53.

174. Stiell IG, Wells GA, Vandemheen KL. The Canadian C-spine rule for radiography in alert and stable trauma patients. JAMA 2001;286:1841-8.

175. Kjellman GV, Skargren EI, Oberg BE. A critical analysis of randomised clinical trials on neck pain and treatment efficacy. A review of the literature. Scand J Rehabil Med 1999;31:139-52.

176. Koes BW, Assendelft WJ, van der Heijden GJ. Spinal manipulation and mobilisation for back and neck pain: a blinded review. BMJ 1991;303:1298-303.

177. Zajt-Kwiatkowska J, Rajkowska-Labon E, Skrobot W, Bakula S, Szamotulska J. Application of kinesio taping for treatment of sport injuries. Research Year- Book 2007; 13: 130-134.

178. Yoshida A, Kahanov L. The effect of Kinesiotaping on lower trunk range of motions. Res Sports Med 2007; 15: 103-112.

179. Murray H, Husk LJ. Effect of Kinesiotaping on proprioception in the ankle (abstract). J Orthop Sports Phys Ther 2001; 31: A37.

180. Osterhues DJ. The use of Kinesiotaping in the management of traumatic patella dislocation: A case study. Physiother Theor Pract 2004; 20: 267-170.

181. Kase K, Wallis J. The latest Kinesiotaping method. Tokyo Ski-journal: 2002.

182. Kase K, Wallis J, Kase T. Clinical Therapeutic Applications of the Kinesio Taping Method. Tokyo, Japan: Ken Ikai Co Ltd; 2003.

183. García-Muro F, Rodríguez-Fernández AL, Herrero-de-Lucas A. Treatment of myofascial pain in the shoulder with Kinesio Taping: A case report. Man Ther 2010; 15: 292-295.

184. Thelen MD, Dauber JA, Stoneman PD. The clinical efficacy of kinesio tape for shoulder pain: a randomized, double-blinded, clinical trial. J Orthop Phys Ther 2008; 38: 389-395.

185. González-Iglesias J, Fernández-de-las-Peñas C, Cleland JA, Huijbregts P, Gutiérrez-Vega MR. Short-term effects of cervical Kinesio Taping on pain and cervical range of motion in patients with acute whiplash injury: A Randomized Clinical Trial. J Orthop Phys Ther 2009; 39: 515-521.

OBJETIVOS.

GENERAL

Analizar la eficacia de la terapia manipulativa y el kinesio taping en la cervicalgia crónica del origen mecánico.

ESPECIFICOS:

- Desarrollar una regla de predicción clínica, basada en un grupo de signos y síntomas derivados de la historia y del examen físico, e identificar aquellos pacientes con dolor mecánico cervical capaces de beneficiarse de un protocolo de manipulación de la columna cervico-dorsal.

- Conocer la eficacia comparativa sobre el dolor mecánico cervical crónico mediante la manipulación aislada cervical respecto a la manipulación combinada cervico-dorsal sobre el rango de movimiento articular y el dolor percibido por el paciente.

- Comparar la eficacia de la técnica de Kinesio taping® y manipulación cervical semidirecta a nivel de C3 y C7-T1, sobre el rango de movimiento articular de la columna cervical, así como, los cambios en la sintomatología dolorosa en un grupo de pacientes con cervicalgia crónica.

- Evaluar las relaciones entre intensidad de dolor, desequilibrio funcional y conductas de evitación al movimiento relacionadas con el dolor mecánico cervical crónico mediante terapia manipulativa espinal y kinesio taping.

MATERIAL Y MÉTODOS.

En las tablas 1, 2, 3 y 4 se muestra el Material y los Métodos utilizados en los diferentes artículos que constituyen la presente memoria de Tesis.

Tabla 1. Tabla resumen del material y métodos utilizados en el artículo I.

ARTÍCULO	DISEÑO DEL ESTUDIO	SUJETOS	INTERVENCIÓN	VARIABLES	METODO
I. Predictors for Identifying Patients with Mechanical Neck Pain who are Likely to Achieve Short-term Success with Manipulative Interventions Directed at the Cervical and Thoracic Spine.	Estudio Prospectivo Simple.	81 sujetos con dolor mecánico cervical.	Manipulación Espinal (Thrust): - Técnica Manipulativa en Columna Cervical Alta, Charnela Cérvico-Dorsal y Columna Cervical Media. - Periodo entre sesiones: 2-4 días.	103 Variables: - Diagrama Corporal de Localizacion de Síntomas. - Escala Numérica de Rango de Dolor. - Índice Numérico de Discapacidad. - Escala de Kinesiofobia de Tampa (TSK). - Historia Clínica: naturaleza del dolor, factores agravantes y factores que mejoran el dolor, examen físico, test neurológicos y examen postural. - Rango de Movimiento Cervical . - Rotación Activa Torácica. - Movilidad Articular y Respuesta Sintomática en Movilidad Articular - Examen Específico de Dolor Cervical y Radiculopatía. - Cambio de Rango Global.	- Cuestionario del Dolor McGill. - 11 Puntos de la Escala (NPRS). - Cuestionario Discapacidad Cervical (NDI). - Versión Reducida de la Escala de Kinesiofobia de Tampa (TSK-11). - Cuestionario con 6 Dominios. - Goniómetro Estándar. - Examen Bilateral. - Test de Spring C2-T9. - Test de Distracción Cervical, Test de Spurling y Test Neurodinámico de Miembro Superior. - Cuestionario para Cambio de Rango Global (GROC).

Tabla 2. Tabla resumen del material y métodos utilizados en el artículo II.

ARTÍCULO	DISEÑO DEL ESTUDIO	SUJETOS	INTERVENCIÓN	VARIABLES	METODO
II. Short-term effects of kinesio Taping Versus Cervical Thrust Manipulacion in Patients with Mechanical Neck Pain: A Randomized Clinical Trial.	Ensayo Clínico Randomizado.	80 sujetos con dolor mecánico cervical: - Grupo Técnicas de Manipulación Espinal (n= 40). – Grupo Kinesio Taping (n= 40).	Manipulación Espinal (Thrust): - Técnica de Thrust en Columna Cervical Media y Charnela Cérvico- Dorsal. - Vendaje Neuromuscular (Kinesio Taping): Técnica de Aplicación en "Y" sobre musculatura extensora cervical (T1- C1), y segunda tira de forma perpendicular en región C3-C6.	4 Variables: - Escala Numérica de Rango de Dolor. - Índice Numérico de Discapacidad. - Diagrama Corporal de Localizacion de Síntomas. - Rango de Movimiento Cervical (CROM).	- 11 Puntos de la Escala (NPRS). - Cuestionario Discapacidad Cervical (NDI). - Cuestionario del Dolor McGill. - Goniómetro Estándar.

Tabla 3. Tabla resumen del material y métodos utilizados en el artículo III.

ARTÍCULO	DISEÑO DEL ESTUDIO	SUJETOS	INTERVENCIÓN	VARIABLES	METODO
III. Short-term Effects of Spinal Thrust Joint Manipulation in Patients with Chronic Mechanical Neck Pain: A Randomized Clinical Trial.	Ensayo Clínico Randomizado.	82 sujetos con Dolor Mecánico Cervical: - Una Intervención Manipulativa Cervical (n=41). - Tres Intervenciones Manipulativas Espinales (n=41).	Manipulación Espinal (Thrust): - Técnica de Thrust en Columna Cervical Media. - Técnica de Thrust en Columna Torácica Alta, Charnela Cérvico-Dorsal y Cervical Media.	3 Variables: - Escala Numérica de Rango de Dolor. - Índice Numérico de Discapacidad. - Rango de Movimiento Cervical (CROM).	- 11 Puntos de la Escala (NPRS). - Cuestionario Discapacidad Cervical (NDI). - Goniómetro Estándar.

Tabla 4. Tabla resumen del material y métodos utilizados en el artículo IV.

ARTÍCULO	DISEÑO DEL ESTUDIO	SUJETOS	INTERVENCIÓN	VARIABLES	METODO
IV. Pain Intensity, physical impairment and pain-related fear to function in patient with chronic mechanical cervical pain.	Estudio Descrptivo	120 Sujetos con Dolor Mecánico Cervical (35 Hombres y 85 Mujeres).	Sin Intervención	4 Variables: - Variables Demográficas. - Intensidad del Dolor. - Escala de Kinesiofobia de Tampa (TSK). - Rango de Movimiento (ROM). - Índice Numérico de Discapacidad.	- Cuestionario de 5 Dimesiones. - 11 Puntos de la Escala (NPRS). - Versión Reducida de la Escala de Kinesiofobia de Tampa (TSK-11). - Goniómetro Estándar. - Cuestionario Discapacidad Cervical (NDI).

RESULTADOS Y DISCUSIÓN

En los siguientes artículos publicados y/o sometidos se exponen tanto los resultados como la discusión de los mismos.

I. Predictors for Identifying Patients with Mechanical Neck Pain Who Are Likely to Achieve Short-Term Success with Manipulative Interventions Directed at Cervical Thoracic Spine.

Autores: Saavedra-Hernández M, Castro-Sánchez AM, Fernández-de-las-Peñas C, Cleland J, Ortega-Santiago R, Arroyo-Morales M. J Manipulative Phys. 2011; 34(3)144-52.

ORIGINAL ARTICLES

PREDICTORS FOR IDENTIFYING PATIENTS WITH MECHANICAL NECK PAIN WHO ARE LIKELY TO ACHIEVE SHORT-TERM SUCCESS WITH MANIPULATIVE INTERVENTIONS DIRECTED AT THE CERVICAL AND THORACIC SPINE

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ABSTRACT

Objective: The purpose of this study was to identify the prognostic factors for individuals with mechanical neck pain likely to experience improvements in both pain and disability after the application of an intervention including cervical and thoracic spine thrust manipulations.
Methods: Patients presenting with mechanical neck pain participated in a prospective single-arm trial. Participants underwent a standardized examination and then received a series of thrust manipulations directed toward the cervical, cervicothoracic, and thoracic spine. Participants were classified as having achieved a successful outcome at the second and third sessions based on their perceived recovery. Potential prognostic variables were entered into a stepwise logistic regression model to determine the most accurate set of variables for the prediction of treatment success.
Results: Data from 81 subjects were included in the analysis, of which 50 experienced a successful outcome (61.7%). Five variables including pain intensity greater than 4.5 points; cervical extension less than 46°; presence of hypomobility at T1; a negative upper limb tension test and female sex were identified. If 4 of 5 variables were present (likelihood ratio, +1.9), the likelihood of success increased from 61.7% to 75.4%.
Conclusions: This study identified several prognostic clinical factors that can potentially identify, a priori, patients with neck pain who are likely to experience a rapid response to the application of an intervention including both cervical and thoracic spine manipulations. However, no combination of the variables was able to dramatically increase the posttest probability. (J Manipulative Physiol Ther 2011;34:144-152)
Key Indexing Terms: *Neck Pain; Manipulation; Cervical Spine; Thoracic Spine*

Mechanical neck pain represents a significant health care problem in any country. It has been reported that the lifetime and point prevalence of neck pain is almost as high as the prevalence of low back pain.[1,2] The 1-year prevalence for neck pain has been reported to range from 16.7% to 75.1%, with a mean of 37.2%.[1] Neck pain continues to be a source of significant health care expenditures.[3]

Spinal manipulation is a manual therapy technique often used by different therapists for the management of neck pain patients.[4] Although several studies have demonstrated the effectiveness of cervical[5-7] and thoracic[8,9] manipulation for the management of neck pain, there continue to remain controversy in relation to their effectiveness over other interventions.[4] Inconsistencies may be attributable to the fact that mechanical neck pain is a heterogeneous pain

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Paper submitted November 2, 2010; in revised form February 2, 2011; accepted February 10, 2011.
0161-4754/$36.00

doi:10.1016/j.jmpt.2011.02.011

condition, and it is commonly seen in clinical practice that not all patients with mechanical neck pain benefit from the same intervention.[10]

Recently, there have been a number of studies identifying the prognostic variables to guide interventions for the management of low back pain,[11] tension-type headache,[12] ankle sprains,[13] cervicogenic headache,[14] and shoulder pain.[15] Two of these studies purported to identify predictors for identifying patients with neck pain who will benefit from either cervical[16,17] or thoracic[18] spine manipulation. Six predictors including Neck Disability Index (NDI) less than 11.5 points, bilateral symptoms, not performing sedentary work more than 4.5 hours a day, feeling better moving the neck, neck extension does not aggravate the symptoms, and no diagnosis of radiculopathy were identified for success cervical manipulation.[16] Six variables were also identified for success of thoracic thrust manipulation; however, it has recently been demonstrated that these variables were simply spurious findings and did not predict prognosis.[19] Furthermore, the results of this study suggest that patients with mechanical neck pain who do not exhibit contraindications should receive thoracic manipulation. However, simply using just cervical or thoracic manipulation may not be representative of usual clinical practice, because therapists usually apply different manipulative interventions for the management of neck pain. Therefore, it would be of clinical utility to have guidance in selecting patients with neck pain who may experience improved outcomes after interventions including cervical and thoracic spine manipulations. However, it is not known if patients who are likely to have a favorable outcome can be predicted in this patient population. Thus, the purpose of the current study was to identify the prognostic factors for patients with mechanical neck pain likely to experience improvements in both pain and disability after the application of an intervention including cervical and thoracic spine thrust manipulations.

Methods

We conducted a prospective single-arm study of consecutive patients presenting with mechanical neck pain who were referred for therapy at one clinical site in Almeria, Spain. Inclusion criteria required patients to be between the ages of 18 and 60 years, with a primary complaint of mechanical neck pain with or without upper-extremity symptoms. *Mechanical neck pain* was defined as generalized neck and/or shoulder pain provoked by neck postures, neck movement, or palpation of the neck muscles. Exclusion criteria were as follows: (1) any contraindication to spinal manipulation: positive extension-rotation test, infection, osteoporosis, or nystagmus; (2) history of cervical surgery or whiplash injury; (3) medical diagnosis of cervical radiculopathy or myelopathy; (4) diagnosis of fibromyalgia[20]; (5) previous treatment with spinal manipulative therapy; or (6) evidence of any central nervous system involvement, or signs consistent with nerve root compression. All subjects read and signed a consent form, and this study was approved by the ethics board of the Universidad de Granada.

Examination Procedures

The examination procedures were conducted in the identical fashion to a previous clinical prediction rule derivation study for patients with neck pain.[18] Patients provided demographic and clinical information and completed different self-report measures at baseline, which included a body diagram to assess the distribution of symptoms,[21] a numeric pain rating scale (NPRS) for assessing the intensity of the pain,[22] NDI,[23] and the Tampa Scale for Kinesiophobia (TSK).[24]

Patients recorded the location of the symptoms on the body diagram to determine the most distal extent of their symptoms. The body diagram has shown to be a reliable method to localize the patient's pain symptoms.[25] The NPRS (range: 0, no pain; 10, maximum pain) was used to assess the mean spontaneous neck pain intensity. In fact, NPRS has shown to be reliable and valid for pain assessment.[26]

The NDI consist of 10 questions measured on a 6-point scale (0, no disability; 5, full disability).[23] The numeric score for each item is summed for a total score varying from 0 to 50, where higher scores reflect greater disability. The NDI has demonstrated to be a reliable and valid self-assessment of disability in patients with neck pain.[27] Finally, we used the 11-item TSK that assesses fear of movement or of injury or reinjury.[24] Individuals rate each item on a 4-point Likert scale, with scoring alternatives ranging from "strongly disagree" to "strongly agree." Test-retest reliability is high.[24]

The clinical history included questions regarding the onset, nature and location of symptoms, aggravating and relieving factors, and history of neck pain. The physical examination began with a neurologic screen followed by an assessment of the posture as previously described.[18] The clinician next measured the cervical range of motion and symptoms response[28] with a cervical range of motion goniometer, which has shown intratester reliability between 0.87 and 0.96 in individuals with neck pain.[29] Symptom response (no pain, increase, or decrease of pain) during active rotation of the thoracic spine was also recorded.[30] The presence of joint mobility (normal, hypomobile, or hypermobile) and symptoms response (pain or no pain) were recorded for segmental mobility testing of the cervical spine and for spring testing of the cervical and thoracic spine (C2-T9).[31] The examination culminated with different tests performed in the examination of individuals with neck pain and cervical radiculopathy[32]: the Spurling test, the Neck Distraction Test, and Upper Limb Neurodynamic Test. For the Upper Limb Neurodynamic Test, any of the following constitute a positive test: (1) symptom reproduction, (2) a difference less than 10° in between limbs in elbow extension at the end of the test, and (3) an increase in symptoms with contralateral cervical side bending or decrease symptoms with ipsilateral side bending.[32] A total of 103 clinical variables were collected during the examination. This clinical examination has been previously used in different studies attempting to identify potential predictors of prognosis.[15,18]

Spinal Manipulation Intervention

Because treatment outcome served as the reference criterion,[33] all patients received, on each session, 3 thrust manipulation techniques targeted at the midcervical spine, cervicothoracic junction, and upper thoracic spine region. Because we wanted to mimic the commonly clinical practice for the management of patients with neck pain, clinicians choose the level of spinal thrust manipulation in the cervical and thoracic spine based on the clinical findings. The clinical finding criteria for application of spinal manipulation were the presence of hypomobility (abnormal end-feel and increased tissue resistance) combined with pain provocation during the test. The 3 techniques took less than 5 minutes and were conducted as follows[34]:

1. Upper thoracic spine "distraction" manipulation: patients were supine with the arms crossed over the chest and hands passed over the shoulders. The therapist placed their upper chest at the level of the patient's middle thoracic spine and grasped the patient's elbows. Gentle flexion of the thoracic spine was introduced until slight tension was felt in the tissues at the contact point. Then, a distraction thrust manipulation in an upward direction was applied (Fig 1). If no popping sound was heard on the first attempt, the therapist repositioned the patient, and performed a second manipulation. A maximum of 2 attempts were performed on each patient.
2. Cervicothoracic junction manipulation: this technique was applied bilaterally. Here we describe the procedure for a right C7-T1 manipulation; that is, the contact was on the right side of the cervicothoracic junction. The patient was prone with the head and neck rotated to the left. The therapist stands on the left side of the patient facing cephalic. The therapist's right hand makes contact with the thumb on the right side of the spinous process of T1. The therapist's left hand supports the head of the patient. The head/neck is gently laterally flexed to the right, until slight tension is palpated in the tissues. A high-velocity low-amplitude thrust was applied toward the subjects' left side (Fig 2). Again, a maximum of 2 attempts were performed for each side.
3. Midcervical spine manipulation: the subject was supine with the cervical spine in a neutral position. The index finger of the therapist applied contact over the posterior-lateral aspect of the zygapophyseal joint of C3. The therapist cradled the patient's head with the other hand. Gentle ipsilateral side flexion and contralateral rotation to the targeted side is introduced until slight tension was perceived in the tissues at the contact point (Fig 3). A high-velocity low-amplitude thrust manipulation was directed upward and medially in the direction of the subject's contralateral eye. Again, a maximum of 2 attempts were performed.

Fig 1. *Upper thoracic spine "distraction" manipulation.*

The first treatment was always performed on the day of the initial examination, and the patients were scheduled for a follow-up visit within 2 to 4 days. At the start of the second session, subjects completed the Global Rating of Change (GROC), NDI, and NPRS and were judged to have a successful or nonsuccessful outcome (see the following section). If the subject did not meet the threshold for success at the second visit, a second treatment session was applied, and a second follow-up visit was scheduled. At the third visit, they again completed the GROC, NDI, and NPRS and were categorized accordingly. After the third visit, their participation in the study was complete, and treatment was administered at the discretion of their therapist.

Fig 2. *Cervicothoracic junction manipulation.*

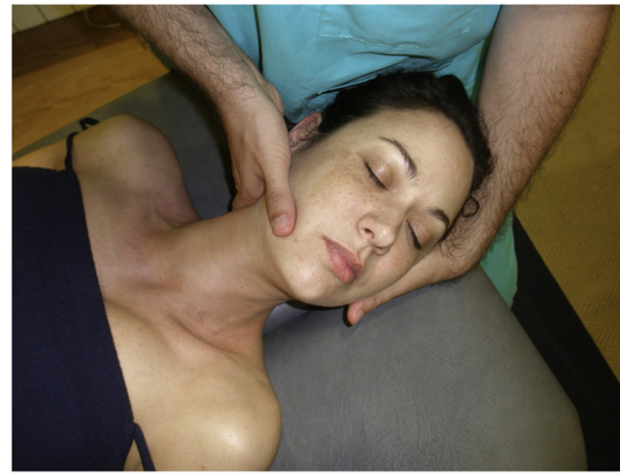

Fig 3. *Midcervical spine manipulation.*

Determination of Success

The perceived improvement level was used as a reference criterion for establishing a successful outcome. Patients self-perceived improvement was assessed using a GROC, which consists of a 15-point scale ranging from −7 (a very great deal worse) to +7 (a very great deal better).[35] Descriptors of worsening or improving were assigned with values ranging from −1 to −7 and +1 to +7, respectively.[36] It has been reported that scores of +4 and +5 are indicative of moderate changes in patient status, whereas scores of +6 and +7 indicate large changes in the status of the patient. Therefore, in the current study, we consider responders those patients who reported a GROC of a score of +5 or greater ("a very great deal better," "a great deal better," or "quite a bit better"). We set +5 as threshold for success because this score represents clinically meaningful improvements, and because of the short duration of this study, it would be likely that the clinical outcome would be attributable to the treatment rather than the passage of time.

Data Analysis

Participants were dichotomized as either responders or nonresponders based on the treatment response at either the time of the second or third visit as indicated by a score of +5 or greater on the GROC. Variables from self-report measures, the history, and clinical examination were tested for univariate relationship with the reference criteria using χ^2 tests for categorical variables and independent *t* tests for continuous variables at the follow-up. Any of the 103 variables with a significance level of $P < .10$ were retained as potential prediction variables.[37] For continuous variables with a significant univariate relationship, sensitivity and specificity values were calculated for all possible cutoff points and then plotted as a receiver operator characteristic curve. The point on the curve nearest the upper left-hand corner represented the value with the best diagnostic accuracy, and this point was selected as the cutoff defining a positive test.[38] Sensitivity, specificity, and positive and negative likelihood ratios (LRs) were calculated for potential predictor variables. If there was an empty cell in the 2 × 2 contingency table, a value of 0.5 was added to each cell to allow for calculations as described by Wainner et al.[32] All potential predictor variables were entered into a stepwise logistic regression model to determine the most accurate set of predictor variables for treatment success. A significance level of $P < .10$ was required for removal from the equation to minimize the likelihood of excluding potentially helpful variables.[38] The variables retained in the regression model were obtained as the most optimal cluster for predicting individuals with mechanical neck pain who are likely to have a successful outcome. The Hosmer-Lemeshow summary goodness-of-fit statistic was used to assess the fit of the model to the data and tested the hypothesis that the model fit the data.[39] All the analyses were performed with SPSS version 14.0 software (SPSS, Chicago, IL).

Results

Between September 2009 and March 2010, 100 patients with a primary report of neck pain were screened for eligibility criteria. Eighty-one individuals (81%) satisfied the criteria for the study and agreed to participate. The number of patients screened, reasons for ineligibility, and dropout can be seen in Figure 4. Patient demographics and initial baseline variables from the history and self-report measures for the entire sample as well as for both the responders and nonresponders groups can be found in Table 1. Categorical variables from the clinical examination with a significant difference ($P < .01$) between responders

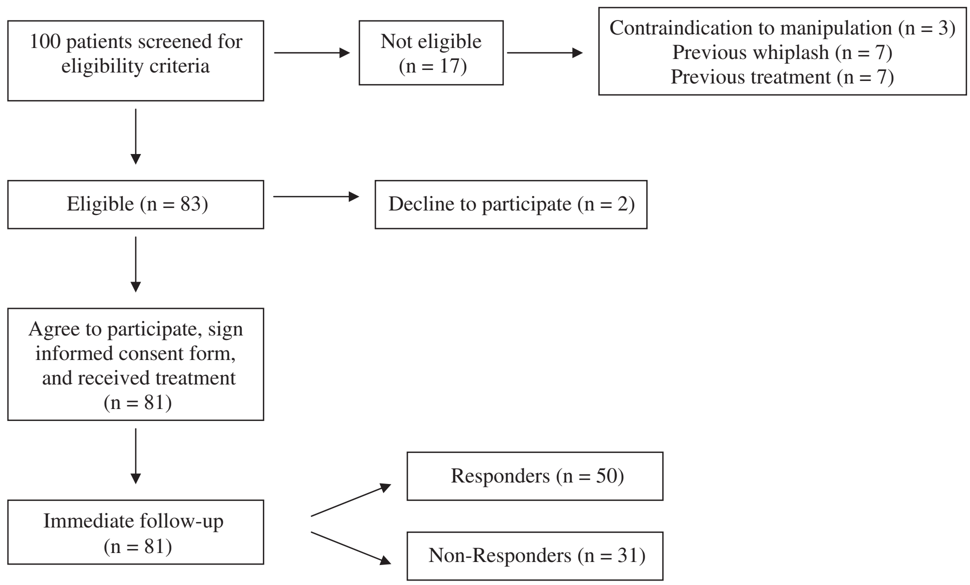

Fig 4. *Flow diagram of subject recruitment and retention throughout the course of the study.*

Table 1. *Demographics, baseline self-report variables, and baseline characteristics of subjects*

Variable	All subjects (n = 81)	Responders (n = 50)	Nonresponders (n = 31)	Significance
Age (y), mean (SD)	39.4 (9.2)	38.9 (4.1)	40.1 (9.0)	.58 [a]
Sex: female, n (%)	55 (70)	38 (76)	17 (55)	.08 [b, c]
Duration of symptoms (d), median (SD)	1703.2 (1726.5)	1610.3 (1571.9)	1904.9 (1960.0)	.47 [a]
NPRS, mean (SD)	4.8 (1.7)	5.2 (1.6)	4.3 (1.8)	.03 [a, c]
NDI, mean (SD)	14.2 (5.2)	15.0 (4.9)	13.1 (5.4)	.095 [a, c]
TSK, mean (SD)	24.2 (7.2)	24.7 (7.3)	23.4 (7.2)	.44 [a]
Cervical range of motion:				
Flexion degrees, mean (SD)	53.4 (10.5)	54.5 (10.9)	51.5 (9.8)	.21 [a]
Extension degrees, mean (SD)	49.0 (10.2)	47.2 (10.1)	51.5 (9.9)	.066 [a, c]
Side-bending right degrees, mean (SD)	37.7 (7.3)	37.9 (7.1)	37.3 (7.6)	.71 [a]
Side-bending left degrees, mean (SD)	38.8 (5.7)	39.1 (6.0)	38.1 (5.0)	.47 [a]
Rotation right degrees mean (SD)	69.5 (11.2)	69.8 (11.3)	68.4 (10.7)	.59 [a]
Rotation left degrees, mean (SD)	71.2 (11.5)	70.9 (10.4)	71.1 (12.1)	.95 [a]

[a] χ^2 tests.
[b] Independent samples *t* tests.
[c] A cutoff of +5 of the GROC was used to categorize "improved."

and nonresponders are summarized in Table 2. Fifty patients (61.7%) were categorized as responders, and the remaining 31 (38%) as nonresponders. Thirty-three subjects (40.2%) were classified as having a successful outcome after the first session, and the remaining 17 (21.5%) were classified as having a successful outcome after 2 sessions.

The analysis of the change scores revealed that the responder group exhibited significantly greater improvements (P < .001) in pain (NPRS change score, 3.1; 95% confidence interval [CI], 2.4-3.8) and disability (NDI change score, 43.7%; 95% CI, 31.8-55.70) as compared with the nonresponder group (NPRS change score, 1.1; 95% CI, 0.8-1.9; NDI change score, 12.4%; 95% CI, 2.3-23.2).

Eight potential variables for predicting prognosis at the follow-up were identified and entered into the logistic regression (Table 3). The cutoff for continuous variables as identified by the receiver operator characteristic curves were pain intensity greater than 4.5 points and cervical extension less than 46°. Sensitivity, specificity, and positive LR (and 95% CI) for all 8 variables can be found in Table 3. The positive LR ranged from 1.4 to 2.7, with the strongest predictor being the presence of hypomobility at T1 vertebra.

Of these 8 variables, 5 were retained in the final regression model for predicting outcome: pain intensity greater than 4.5 points; cervical extension less than 46°; presence of hypomobility at T1; a negative upper limb tension test (ULTT), and female sex (P < .001, Nagelkerke

Table 2. *Categorical variables from the baseline clinical examination with a significant difference (P < .10) between responders and nonresponders*

Variable	All subjects (n = 81)	Responders (n = 50)	Nonresponders (n = 31)	Significance (χ^2)
Shoulder protraction (%)	66 (81.4)	44 (88)	22 (71)	.08
Atlanto-axial joint mobility hypomobile (%)	25 (30.9)	19 (37.3)	6 (19.4)	.09
Hypomobility T1 (%)	16 (19.7)	13 (26)	3 (9.7)	.09
Sex: female (%)	55 (67.9)	38 (76)	17 (54.8)	.08
ULTT negative (%)	46 (56.8)	33 (66)	13 (41.9)	.04

Table 3. *Accuracy statistics with 95% CIs for individual predictor variables*

Variable	Sensitivity (95% CI)	Specificity (95% CI)	Positive LR (95% CI)	Probability of success (%)
Pain >4.5	0.66 (0.51-0.78)	0.55 (0.36-0.72)	1.4 (0.95-2.6)	69.3
Extension range of motion less than 46	0.44 (0.30-0.59)	0.74 (0.55-0.87)	1.7 (0.87-3.3)	73.3
Hypomobility T1	0.26 (0.15-0.41)	0.90 (0.73-0.97)	2.7 (0.83-8.7)	81.3
ULTT negative	0.66 (0.51-0.78)	0.58 (0.39-0.75)	1.6 (0.99-2.5)	72
Sex: female	0.77 (0.63-0.88)	0.43 (0.26-0.62)	1.4 (0.97-1.9)	69.3
Pain with mobility testing of Atlanto-axial joint	0.38 (0.25-0.53)	0.81 (0.62-0.92)	2.0 (0.88-4.4)	76.3
Neck disability >13	0.60 (0.45-0.73)	0.55 (0.36-0.72)	1.3 (0.85-2.1)	67.7
Shoulder protraction	0.88 (0.75-0.95)	0.29 (0.15-0.48)	1.2 (0.97-1.6)	65.9

The probability of success is calculated using the positive LRs and assumes a pretest probability of 61.7%.

Table 4. *Combination of predictor variables and associated accuracy statistics with 95% CIs*

- Pain greater than 4.5
- Extension range of motion less than 46
- Hypomobility T1
- ULTT negative
- Sex: female

No. of predictor variables present	Satisfied	Did Not Satisfy	Sensitivity	Specificity	Positive LR	Probability of success (%)
5+	1	80	0.29 (0.03-0.13)	0.98 (0.91-0.99)	1.9 (0.08-44.8)	75.37 [a]
4+	6	75	0.12 (0.05-0.25)	0.94 (0.77-0.99)	1.9 (0.40-8.6)	75.4
3+	26	55	0.52 (0.38-0.66)	0.65 (0.45-0.80)	1.5 (0.85-2.5)	70.7
2+	42	39	0.84 (0.70-0.92)	0.29 (0.15-0.48)	1.2 (0.92-1.5)	66
1+	48	33	0.96 (0.85-0.99)	0.16 (0.06-0.34)	1.1 (0.97-1.3)	63.9

The probability of success is calculated using the positive LRs and assumes a pretest probability of 61.7%. Accuracy statistics with 95% CIs for individual variables for predicting success.

[a] Added 0.05 to each cell of the 2 × 2 table to account for an empty cell according to the guidelines of Wainner et al.[39]

R^2 = 0.38). The results of the Hosmer-Lemeshow test indicated that the model adequately fit the data (P = .38). These 5 variables were used to form a combination of predictors for identifying patients with mechanical neck pain likely to benefit from spinal manipulation. Sensitivity, specificity, and positive LR (and 95% CI) were calculated for the numbers of variables present (Table 4).

The pretest probability for a favorable outcome was 61.7%. If 1 of the 5 variables was present, the posttest probability was 63.9% (LR+, 1.1; 95% CI, 0.97-1.3). If 2 of the 5 variables were present, then the posttest probability increased to 66% (LR+, 1.2; 95% CI, 0.92-1.5). If 3 variables were present, the posttest probability was 70.7% (LR+, 1.5; 95% CI, 0.85-2.5). If 4 of 5 variables were present, the LR+ was 1.9 (95% CI, 0.40-8.6), and the posttest probability was 75.4%. If all the variables were present, we needed to add 0.5 to each cell in the 2 × 2 table, which resulted in a LR+ of 1.9 and a posttest probability of 75.4%.

Discussion

We have attempted to identify prognostic clinical factors that may potentially identify, a priori, patients with mechanical neck pain who are likely to experience a rapid response after the application of a therapy intervention including cervical and thoracic spine thrust manipulations. Five variables including pain intensity greater than 4.5 points, cervical extension less than 46°, hypomobility at T1 vertebra, a negative ULTT, and female sex were identified. If 4 of 5 variables were present (LR+, 1.9), the likelihood of success increased from 61.7% to 75.4%. If all the variables were present, the +LR was 1.9 and the posttest probability remained consistent at 75.4%. Although we identified variables that may have plausibly been predicted, no parsimonious subset of them could substantially raise the posttest probability of success.

The identified variables posed at least a degree of face validity. The high pain score may have fallen out as a predictor because it could plausibly be that those folks who have a more severe pain may have room for quicker improvements with the appropriate intervention or spontaneous recovery, or it could simply be that patients with a higher intensity of pain are more likely to recover.[40] Restricted cervical extension would theoretically make sense as patients with neck pain often exhibit impaired biomechanics of the cervicothoracic (C7-T1) region.[41-43] This would also lend credibility for the hypomobility identified at T1, which has historically been used as a method to identify patients who should receive thrust manipulation.[31] In addition, we cannot exclude the neurophysiologic mechanisms of spinal manipulation.[44] In fact, it has been reported that C7-T1 manipulation induced hypoalgesic effects, that is, an increase in pressure pain thresholds in the cervical spine in healthy subjects.[45]

A negative ULTT suggests that the patients in this study likely present without neurogenic symptoms, which may render them more likely to recover rapidly then a group with neck and arm pain. This coincides with the study by Tseng et al,[16] who found that patients without cervical radiculopathy had a better outcome with cervical spine thrust manipulation. The reason why the female sex was identified as a prognostic variable remains a bit elusive. It has been demonstrated that sex in itself is not a predictive factor of outcome[46]; however, it has been also shown in other studies in patients with whiplash associated disorders that male sex was a predictor of poor expectations for recovery.[47]

We did not identify a subset of factors likely to identify prognosis in this study; it might be that this subgroup of patients cannot easily be identified. This would be in agreement with the study of Cleland et al[19] that demonstrated that the previously identified predictor variables could not be identified. Given the rapid improvement associated with manipulative techniques in the management of patients with neck pain, we also agree that given the minute risks and the obvious benefit, manual techniques are likely beneficial for most patients with neck pain.[19]

Limitations

There are some limitations to the current study. First, the absence of a control group does not allow for inferences to be made regarding cause and effect, so it cannot be determined if the rule predicted response to treatment or simply identified patients with a good prognosis. Future randomized clinical trials are required to validate the variables in the rule before it can be suggested for widespread clinical application. In fact, it has been stated that single-arm clinical prediction rules are vulnerable to a regression effect, where the variables entered into the logistic regression may have resulted in overfitting of the model, which can lead to spurious findings).[48] However, in the development stages of a possible clinical prediction rule, it is important and necessary to include all potential predictor variables. Nevertheless, as is the case with all statistical modeling, the results presented here will require validation, which can include performing the study on an independent sample of patients.[49] Therefore, these results should be considered as a temporary and exploratory first analysis.

Second, we should recognize that we collected only data for short-term outcomes and after 1 or 2 sessions of treatment. Therefore, we do not know whether the patients classified as responders were still doing well at a longer-term follow-up, and if some patients classified as nonresponders can be classified as having a successful outcome with consecutive treatment sessions. Finally, it is possible that our sample was small. Methods for calculating sample size for multivariate analyses suggest that studies need at least 50 subjects for the first independent variable and 8 for each of the subsequent ones, which would give a greater sample size of that one included in the current study. Future studies are now needed to elucidate these questions.

Conclusions

We have identified several potential prognostic clinical factors including pain intensity greater than 4.5 points, cervical extension less than 46°, hypomobility of T1 vertebra, a negative ULTT, and female sex that may potentially identify, a priori, patients with mechanical neck pain who are likely to have an overall good prognosis. However, no combination of the variables was able to dramatically increase the posttest probability. Therefore, we would recommend the use of manual therapy techniques in this pain patient population considering the small inherent risks and likelihood of benefit. Future studies should compare the effects of thoracic and cervical spine manipulation in a patient population with mechanical neck pain.

Practical Applications

- The current study identified several prognostic clinical factors including pain intensity greater than 4.5 points, cervical extension less than 46°, hypomobility of T1 vertebra, a negative ULTT, and female sex that may potentially identify patients with mechanical neck pain who are likely to experience a rapid and positive response to the application of cervical and thoracic spine thrust manipulations.
- If 4 of 5 variables were present (LR+, 1.9), the likelihood of success increased from 61.7% to 86.3%.
- Future studies are necessary to examine the validity of the predictive value of the prognostic factors identified in this study.

Funding Sources and Potential Conflicts of Interest

No funding sources or conflicts of interest were reported for this study.

References

1. Fejer R, Ohm-Kyvik K, Hartvigsen J. The prevalence of neck pain in the world population: a systematic critical review of the literature. Eur Spine J 2006;15:834-48.
2. Walker B. The prevalence of low back pain: a systematic review of the literature from 1966 to 1998. J Spinal Disord 2000;13:205-17.
3. Martin BI, Deyo RA, Mirza SK, Turner JA, Comstock BA, Hollingworth W, Sullivan SD. Expenditures and health status among adults with back and neck problems. JAMA 2008;299:656-64.
4. American Physical Therapy Association. Guide to physical therapist practice. 2nd edition. Phys Ther 2001;81:9-746.
5. Bronfort G, Evans R, Nelson B, Aker PD, Goldsmith CH, Vernon H. A randomized clinical trial of exercise and spinal manipulation for patients with chronic neck pain. Spine 2001;26:788-99.
6. Evans R, Bronfort G, Nelson B, Goldsmith CH. Two-year follow-up of a randomized clinical trial of spinal manipulation and two types of exercise for patients with chronic neck pain. Spine 2002;27:2383-9.
7. Martínez-Segura R, Fernández-de-las-Peñas C, Ruiz-Sáez M, López-Jiménez C, Rodríguez-Blanco C. Immediate effects on neck pain and active range of motion following a single cervical HVLA manipulation in subjects presenting with mechanical neck pain: a randomized controlled trial. J Man Physiol Ther 2006;29:511-7.
8. González-Iglesias J, Fernández-de-las-Peñas C, Cleland JA, Alburquerque-Sendín F, Palomeque-del-Cerro L, Méndez-Sánchez R. Inclusion of thoracic thrust manipulation into an electrotherapy program for the management of patients with acute mechanical neck pain: a randomized clinical trial. Man Ther 2009;14:306-13.
9. González-Iglesias J, Fernández-de-las-Peñas C, Cleland J, Gutiérrez-Vega M. Thoracic spine manipulation for the management of patients with neck pain: a randomized clinical trial. J Orthop Sports Phys Ther 2009;39:20-7.
10. Fernándezde-las-Peñas C, Cleland JA, Glynn P. Spinal manipulative therapy: from research to clinical practice. Crit Rev Phys Rehabil Med 2008;20:39-53.
11. Flynn T, Fritz J, Whitman J, et al. A clinical prediction rule for classifying patients with low back pain who demonstrate short term improvement with spinal manipulation. Spine 2002;27:2835-43.
12. Fernándezde-las-Peñas C, Cleland JA, Cuadrado ML, Pareja JA. Predictor variables for identifying patients with chronic tension type headache who are likely to achieve short-term success with muscle trigger point therapy. Cephalalgia 2008;28:264-75.
13. Whitman JM, Cleland JA, Mintken P, Keirns M, Bieniek M, Albin SR, Magel J, McPil TG. Predicting short-term response to thrust and non-thrust manipulation and exercise in patients post inversion ankle sprain. J Orthop Sports Phys Ther 2009;39:188-200.
14. Jull G, Stanton W. Predictors of responsiveness to physiotherapy management of cervicogenic headache. Cephalalgia 2005;25:101-8.
15. Mintken PE, Cleland JA, Carpenter KJ, Bieniek ML, Keirns M, Whitman JM. Some factors predict successful short-term outcomes in individuals with shoulder pain receiving cervicothoracic manipulation: a single-arm trial. Phys Ther 2010;90:26-42.
16. Tseng YL, Wang W, Chen W, et al. Predictors for the immediate responders to cervical manipulation in patients with neck pain. Man Ther 2006;11:306-15.
17. Thiel HW, Bolton JE. Predictors for immediate and global responses to chiropractic manipulation of the cervical spine. J Manipulative Physiol Ther 2008;31:172-83.
18. Cleland JA, Childs JD, Fritz JM, et al. Development of a clinical prediction rule for guiding treatment of a subgroup of patients with neck pain: use of thoracic spine manipulation, exercise, and patient education. Phys Ther 2007;87:9-23.
19. Cleland JA, Mintken P, Carpenter K, Fritz JM, Glynn P, Whitman J, Childs JD. Examination of a clinical prediction rule to identify patients with neck pain likely to benefit from thoracic spine thrust manipulation and a general cervical range of motion exercise: a multi-center randomized clinical trial. Phys Ther 2010;90:1239-50.
20. Wolfe F, Smythe HA, Yunus MB, et al. The American College of Rheumatology 1990 criteria for classification of fibromyalgia: report of the multicenter criteria committee. Arthritis and Rheumatism 1990;33:160-70.
21. Werneke MW, Hart DL, Cook D. A descriptive study of the centralization phenomenon: a prospective analysis. Spine 1999;24:676-83.
22. Jensen MP, Turner JA, Romano JM, Fisher L. Comparative reliability and validity of chronic pain intensity measures. Pain 1999;83:157-62.
23. Vernon H, Mior S. The Neck Disability Index: a study of reliability and validity. J Manipulative Physiol Ther 1991;14:409-15.
24. Woby SR, Roach NK, Urmston M, Watson PJ. Psychometric properties of the TSK-11: a shortened version of the Tampa Scale for Kinesiophobia. Pain 2005;117:137-44.
25. Werneke MW, Harris DE, Lichter RL. Clinical effectiveness of behavioral signs for screening chronic low-back pain patients in a work-oriented physical rehabilitation program. Spine 1993;18:2412-8.
26. Katz J, Melzack R. Measurement of pain. Surg Clin North Am 1999;79:231-52.
27. Macdemid JC, Walton DM, Avery S, Blanchard A, Etruw E, Mcalpine C, Goldsmith CH. Measurement properties of the Neck Disability Index: a systematic review. J Orthop Sports Phys Ther 2009;39:400-17.
28. McKenzie RA. Cervical and thoracic spine: mechanical diagnosis and therapy. Minneapolis, Minn: Orthopaedic Physical Therapy Products; 1990.
29. Fletcher JP, Bandy WD. Intrarater reliability of CROM measurement of cervical spine active range of motion in persons with and without neck pain. J Orthop Sports Phys Ther 2008;38:640-5.
30. Cleland JACJ, Fritz JM, Whitman JM. Inter-rater reliability of the historical and physical examination in patients with mechanical neck pain. Arch Phys Med Rehabil 2005;87:1388-95.
31. Maitland G, Hengeveld E, Banks K, English K. Maitland's vertebral manipulation. 6th ed. Oxford, United Kingdom: Butterworth- Heinemann; 2000.
32. Wainner RS, Fritz JM, Irrgang JJ, Boninger ML, Delitto A, Allison S. Reliability and diagnostic accuracy of the clinical examination and patient self-report measures for cervical radiculopathy. Spine 2003;28:52-62.

33. Jaeschke R, Guyatt GH, Sackett DL, the Evidence-Based Medicine Working Group. Users' guides to the medical literature, III: how to use an article about a diagnostic test, B. What are the results and will they help me in caring for my patients? JAMA 1994;271:703-7.
34. Gibbons P, Tehan P. Manipulation of the spine, thorax and pelvis. Edinburgh: Churchill Livingston; 2000.
35. Wyrwich K, Nienaber N, Tierney W, Wolinsky F. Linking clinical relevance and statistical significance in evaluating intra-individual changes in health-related quality of life. Med Care 1999;37:469-78.
36. Jaeschke R, Singer J, Guyatt G. Measurement of health status: ascertaining the minimal clinically important difference. Controlled Clin Trials 1989;10:407-15.
37. Freedman D. A note on screening regression equations. The American Statistician 1983;37:152-5.
38. Deyo R, Centor R. Assessing the responsiveness of functional scales to clinical change: an analogy to diagnostic test performance. J Chronic Dis 1986;39:897-906.
39. Hosmer D, Lemeshow S. Applied logistic regression. New York, NY: John Wiley & Sons Inc; 1989.
40. Bot SD, van der Waal JM, Terwee CB, et al. Predictors of outcome in neck and shoulder symptoms: a cohort study in general practice. Spine 2005;30:E459-70.
41. Norlander S, Gustavsson BA, Lindell J, et al. Reduced mobility in the cervico-thoracic motion segment—a risk factor for musculoskeletal neck-shoulder pain: a two-year prospective follow-up study. Scand J Rehabil Med 1997;29:167-74.
42. Norlander S, Nordgren B. Clinical symptoms related to musculoskeletal neck-shoulder pain and mobility in the cervico-thoracic spine. Scand J Rehabil Med 1998;30:243-51.
43. Norlander S, Norlander U, Nordgren B, et al. Mobility in the cervico-thoracic motion segment: an indicative factor of musculo-skeletal neck-shoulder pain. Scand J Rehabil Med 1996;28:183-92.
44. Souvlis T, Vicenzino B, Wright A. Neuro-physiological effects of spinal manual therapy. In: Boyling JD, Jull GA, editors. Grieves' modern manual therapy: the vertebral column. 3rd ed. Edinburgh: Churchill-Livingstone; 2004. p. 367-79.
45. Fernández-de-las-Peñas C, Alonso-Blanco C, Cleland JA, Rodríguez-Blanco C, Alburquerque-Sendín F. Changes in pressure pain thresholds over C5-C6 zygapophyseal joint following a cervico-thoracic junction manipulation in healthy subjects. J Manipulative Physiol Ther 2008;31:332-7.
46. Hill J, Lewis M, Papageorgiou AC, et al. Predicting persistent neck pain: a 1-year follow-up of a population cohort. Spine 2004;29:1648-54.
47. Ozegovic D, Carroll LJ, Cassidy JD. Factors associated with recovery expectations following vehicle collision: a population-based study. J Rehabil Med 2010;42:66-73.
48. Weeks DL. The regression effect as a neglected source of bias in nonrandomized intervention trials and systematic reviews of observational studies. Eval Health Prof 2007;30:254-65.
49. Concato J, Feinstein A, Holford T. The risk of determining risk with multivariable models. Ann Intern Med 1993;118:201-10.

II. Short-Term Effects of Kinesiotaping versus Cervical Thrust Manipulation In Patients with Mechanical Neck Pain: a Randomized Clinical Trial.

Autores: Saavedra-Hernández M, Castro-Sánchez AM, Arroyo-Morales M, Cleland J, Lara-Palomo I, Fernández-de-las-Peñas C. JOSPT 2012. En prensa.

SHORT-TERM EFFECTS OF KINESIOTAPING VERSUS CERVICAL THRUST MANIPULATION IN PATIENTS WITH MECHANICAL NECK PAIN: A RANDOMIZED CLINICAL TRIAL

Journal:	*Journal of Orthopaedic & Sports Physical Therapy*
Manuscript ID:	Draft
Manuscript Categories:	Research Report
Key Words:	Cervical spine, neck pain, manipulation, clinical trial, Kinesiotaping

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SHORT-TERM EFFECTS OF KINESIOTAPING VERSUS CERVICAL THRUST MANIPULATION IN PATIENTS WITH MECHANICAL NECK PAIN: A RANDOMIZED CLINICAL TRIAL

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Abstract

Design: Randomized clinical trial.

Objective: To compare the effectiveness of cervical spine thrust manipulation and Kinesiotaping® applied to the neck on self-reported disability and cervical range of motion in individuals with mechanical neck pain.

Background: The effectiveness of cervical manipulation has received considerable attention in the literature. However, since some patients cannot tolerate cervical thrust manipulations, alterative therapeutic options should be investigated.

Methods and measures: Eighty patients (36 females) were randomly assigned to 1 of 2 groups: the manipulative group received 2 cervical thrust manipulations, whereas the tape group received Kinesiotaping® applied to the neck. Neck pain (11-point numeric pain rating scale), disability (Neck Disability Index), and cervical range of motion were collected at baseline and one week after the intervention by an assessor blinded to the treatment allocation of the patients. Mixed-model ANOVAs were used to examine the effects of the treatment on each outcome variable with group as the between subject variable, and time as the within subjects variable. The primary analysis was the Group * Time interaction.

Results: No significant Group * Time interactions were found for the 2X2 mixed model ANOVA for pain (F=1.892; P=0.447) or disability (F=0.115; P=0.736). The Group * Time interaction for the 2X2 mixed ANOVA was statistically significant for right (F = 7.317, P=0.008) and left (F=9.525, P=0.003) rotation, but not for flexion (F=0.944; P= 0.334), extension (F=0.122; P=0.728), right (F=0.220; P=0.650) and left (F=0.389, P= 0.535) lateral-flexion: patients receiving the cervical thrust manipulation experienced greater increase in cervical rotation than those receiving the Kinesio Tape application (P < 0.01).

Conclusions: Patients with mechanical neck pain receiving cervical thrust manipulation or an application of Kinesiotaping® exhibited similar reductions in neck pain and disability and similar changes in active cervical range of motion. Changes in neck pain surpassed the minimal clinically important difference (MCID), whereas changes in disability were slightly inferior to the MCID. Changes in cervical range of motion were small and not clinically meaningful since they did not surpass the MCID.

Level of Evidence: Therapy, Level 1b

Key Words: Cervical spine, neck pain, manipulation, clinical trial, Kinesiotaping

SHORT-TERM EFFECTS OF KINESIOTAPING VERSUS CERVICAL THRUST MANIPULATION IN PATIENTS WITH MECHANICAL NECK PAIN: A RANDOMIZED CLINICAL TRIAL

INTRODUCTION

Mechanical neck pain is a significant societal burden and may include symptoms in the neck and upper extremity. It has been reported the lifetime and point prevalence of neck pain is almost as high as the low back pain.[25] A systematic review found that the 1-year prevalence for neck pain symptoms ranging between 16.7% and 75.1% (mean: 37.2%).[13] Additionally, mechanical neck pain results in substantial disability and costs. [5,10,23]

Determining the most appropriate interventions for individuals with neck pain continues to remain a priority for researchers. Physical therapy is usually the first management approach for patients with mechanical idiopathic insidious neck pain with manual therapy often being a preferred intervention.[7]

Although a number of randomized controlled trials exists in support of manual therapy directed at the cervical spine in patients with neck pain.[6,12,19,26,30] However, a recent Cochrane review concluded that only low quality evidence suggests that cervical manipulation provides greater short-term pain relief compared to a control group.[18] Additionally, some individuals with mechanical neck pain may not tolerate or be appropriate candidates for the application of cervical thrust manipulation. Hence, alternative therapeutic strategies should be considered.

Another intervention used clinically in the management of patients with neck pain is KinesioTaping®. KinesioTaping® was a technique developed in the 70s.[21] The adhesive pliable material is used in Kinesio Tape® differs from the classical tape in its physical characteristics. It is a thin and can be stretched up to 120-140% of its original length making it more elastic than conventional tape.[22] Although `physical therapists regularly use KinesioTaping® in clinical practice, particularly with sport injuries,[36] scientific evidence investigating its effectiveness is limited. A few published case reports provide preliminary evidence that Kinesiotaping® may be beneficial in treating acute patellar dislocations,[29] ankle,[28] trunk,[35] and myofascial pain.[16] More recently, 2 randomized clinical trials have demonstrated that Kinesiotaping® may be effective for the treatment of shoulder pain[32] and acute whiplash injury.[17] In patients with shoulder pain, Kinesiotaping® immediately improved pain-free active shoulder range of motion but did not change pain or disability.[32] In individuals with acute whiplash, the application of Kinesiotaping® slighted improved pain and cervical range of motion.[17] However, to date no study evaluated the effects of Kinesiotaping® in patients with mechanical neck pain. The purpose of this randomized controlled trial was to examine the effects Kinesiotaping® versus cervical thrust manipulation on neck pain, self-reported disability and cervical range of motion in patients with mechanical neck pain.

METHODS

Participants

Participants were patients with primary complaint of mechanical idiopathic neck pain who refereed for physical therapy at a private clinic in Almeria-Spain. Mechanical neck pain was defined as generalized neck or shoulder pain provoked by neck postures, neck movement or palpation of the neck musculature. Exclusion criteria included the following: 1) contraindication to neck manipulation; 2) history of whiplash; 3) history of cervical surgery; 4) diagnosis of cervical radiculopathy or myelopathy; 5) diagnosis of fibromyalgia; 6) having previously undergone spinal manipulative therapy or Kinesio

Tape applications; 7) any tape allergy; or 8) less than 18 or greater than 45 years of age. Informed consent was obtained from each patient before entering the study, which was performed in accordance with the Helsinki Declaration. The study was approved by the ethics and research committee of the University of Almeria.

Study Protocol

Patients provided demographic and clinical information and completed a number of self-report measures at baseline, which included a numeric pain rating scale (NPRS) for assessing the intensity of the pain,[20] the Neck Disability Index (NDI) to measure self-perceived disability,[33] and a body diagram to assess the distribution of pain.[34] Once patients completed the self-report measures they underwent cervical range of motion (CROM) testing. They were also screened for any signs of Vertebrobasilar Insufficiency (VBI), such as nystagmus, gait disturbances and Horner's syndrome. Patients also underwent screening for upper cervical spine ligamentous instability.[8]

The NPRS (range: 0, no pain; 10, maximum pain) was used to assess neck pain intensity. The NPRS has shown to be reliable and valid tool for the assessment of pain.[20] The minimal detectable change (MDC) and minimal clinically important difference (MCID) for the NPRS have been reported as 1.3 and 2.1 points, respectively[9]

The NDI consists of 10 questions addressing functional activities such as personal care, lifting, reading, work, driving, sleeping, and recreational activities, as well as pain intensity, concentration, and headache.[33] There are 6 potential responses for each item, ranging from no disability (0) to total disability (5). The NDI is scored from 0 to 50, with higher scores indicating greater disability. MacDermid et al recently concluded that the MDC and the MCID for the NDI were 5 and 7 points out of 50, respectively.[24]

Cervical range of motion (CROM) testing was assessed with the patient sitting comfortably on a chair, with both feet flat on the floor, hips and knees at 90º of flexion, and buttocks positioned against the back of the chair. A CROM goniometer was placed on the top of the head, and patients were asked to move the head as far as possible without any pain in a standard fashion: flexion, extension, right lateral flexion, left lateral flexion, right rotation, and left rotation. The CROM goniometer has been shown to exhibit intra-tester reliability between 0.87 and 0.96 in subjects with neck pain.[15] A recent study reported that the standard error of measurement (SEM) across the six cervical movements ranged from 1.6º to 2.8º, whereas the MDC ranged from 3.6º to 6.5º.[1]

All outcomes were collected at baseline and 7 days after the intervention by an assessor blinded to the treatment allocation of the patients. Patients were blinded to their treatment allocation, as they were naïve to what intervention the other group would receive.

Allocation

Following the baseline examination, patients were randomly assigned to receive KinesioTaping® (tape group) or manipulative interventions directed at the cervical spine (manipulative group). Concealed allocation was performed using a computer-generated randomized table of numbers created prior to the start of data collection by a researcher not involved in either recruitment or treatment of the patients. Individually, sequentially numbered index cards with the random assignment were prepared. The index cards were folded and placed in sealed opaque envelopes. A second therapist, blinded to baseline examination findings, opened the envelope and proceeded with treatment according to the group assignment. All patients received the intervention on the day of the initial examination.

KinesioTaping® Application

The tape [Kinesio Tex, Kinesiotaping®, USA] used in this study was waterproof, porous, and adhesive. Tape with a width of 5cm and a thickness of 0.5mm was used. Patients in this group received the standardized Kinesio Tape application (**Fig 1**). For the application the patients were seated. The first layer was a blue Y-strip placed over the posterior cervical extensor cervical muscles and applied from the insertion to origin with paper-off tension. The paper-off tension tape is manufactured and applied to its paper backing with approximately 15% to 25% stretch.[21,22] Patients were sitting for the application of the Kinesio Tape. Each tail of the first (blue) strip (Y-strip, 2-tailed) was applied with the patients' neck in a position of cervical contra-lateral side bending and rotation. The tape was first placed from the dorsal region (T1-T2) to the upper-cervical region (C1-C2). The overlying strip (black) was a space-tape (opening) placed perpendicular to the Y-strip over the mid cervical region (C3-C6) with the patients' cervical spine in flexion to apply tension to the posterior structures. This application has been also used in a previous study.[17]

Manipulative Interventions

The manipulative group received 2 thrust manipulation interventions directed at the mid-cervical spine and cervico-thoracic junction. For the mid-cervical spine thrust manipulation, the subject was supine with the cervical spine in a neutral position. The index finger of the clinician applied a contact over the posterior-lateral aspect of the zygapophyseal joint of C3. The therapist cradled the patient's head with the other hand. Gentle ipsi-lateral cervical side-flexion and contra-lateral rotation was introduced until slight tension was perceived in the tissues at the contact point (**Fig. 2**). A high-velocity low-amplitude thrust manipulation was directed upward and medially in the direction of the subject's contra-lateral eye.[27] The cervico-thoracic junction thrust manipulation was applied bilaterally. We describe here the procedure for a left C7-T1 manipulation, that is, the contact was on the right side of the C7-T1 junction. The patient was prone with the head and neck rotated to the left. The therapist stood on the left side of the patient facing cephalic. The therapist's right hand made contact with the thumb on the right side of the spinous process of T1. The therapist's left hand supported the head of the patient. The head and neck was gently laterally-flexed to the right, until slight tension is palpated in the tissues. A high-velocity low-amplitude thrust was applied toward the subjects' left side (**Fig. 3**). These 2 manipulative procedures were selected as they are commonly used in clinical practice in patients with neck pain.

Statistical Analysis

Data were analyzed with SPSS© version 18.0 and it was conducted following intention-to-treat analysis. When post-intervention data were missing, baseline scores were used. Baseline demographic and clinical variables were examined between both groups using independent Student t-tests for continuous data and χ^2 tests of independence for categorical data. Separate 2X2 mixed model ANOVAs were used to examined the effects of treatment on pain, self-reported disability and cervical range of motion (flexion, extension, rotation, or lateral-flexion) as the dependent variables, with group (tape or manipulative) as the between subjects variable and time (baseline, 1-week follow-up) as the within subjects variable. The hypothesis of interest was the Group * Time interaction at an a priori alpha-level equal to 0.05.

RESULTS

Ninety-three consecutive patients were screened for eligibility criteria. Eighty patients (mean ± SD age: 45 ± 10 year; 46.5% female) satisfied the eligibility criteria, agreed to participate, and were randomized into Kinesio Tape (n=40) or manipulative (n=40) group. The reasons for ineligibility are found in **Figure 4**, which provides a flow diagram of patient recruitment and retention. Baseline features between the groups were similar for all variables (**Table 1**).

The 2X2 mixed model ANOVA did not find a statistically significant Group * Time interaction for neck pain ($F = 1.892$; $P = 0.447$) or NDI ($F=0.115$; $P=0.736$) as the dependent variable: both groups experienced similar decreases in neck pain and NDI. **Table 2** shows baseline, post-intervention, within-group and between-group differences with associated 95% CI for pain and self-reported disability.

The Group * Time interaction for the 2X2 mixed ANOVA was statistically significant for right ($F = 7.317$, $P = 0.008$) and left ($F = 9.525$, $P = 0.003$) rotation, but not for flexion ($F = 0.944$; $P = 0.334$), extension ($F = 0.122$; $P = 0.728$), right ($F = 0.220$; $P = 0.650$) and left ($F = 0.389$, $P = 0.535$) lateral-flexion: patients receiving the manipulative thrust experienced greater increase in cervical rotation than those patients receiving the Kinesio Tape application ($P < 0.01$). **Table 2** summarizes baseline, post-intervention, within-group and between-group differences with associated 95% CI for cervical range of motion.

DISCUSSION

The results of the current study demonstrated the application of Kinesio Tape and cervical thrust manipulation was equally effective for reducing pain and disability. Additionally both experienced similar improvements in CROM flexion, extension and both directions in lateral-flexion in patients with mechanical neck pain. In addition, individuals who received cervical thrust manipulation exhibited greater increase in cervical rotation than those receiving Kinesio Tape.

The decrease on neck pain in both groups was statistically significant for NPRS, and surpassed the MCID which has been reported to be 2.1 points on a NPRS.[9] Previous studies have reported that cervical thrust manipulation is effective for reducing pain and disability in individuals with mechanical neck pain,[6,12,19,26,30] but this is the first study demonstrating that Kinesiotaping® was also effective for reducing pain and also disability in patients with mechanical neck pain. The current results are similar to those previously identified in patients with acute whiplash,[17] although the reduction in neck pain was greater in the current study. Thelen et al also found that Kinesiotaping® improved pain-free shoulder range of motion in patients with shoulder pain, but it had no effect on spontaneous pain or function.[32] It is important to note that the current study also demonstrated that either cervical thrust manipulation or Kinesiotaping® were able to reduce self-reported disability (NDI). However, changes observed were lower that the reported MCID of 7 points.[24] It is possible that consecutive applications of either Kinesiotaping® or cervical manipulation would result in greater changes.

The current study also identified that patients receiving either intervention exhibited small increases in cervical range of motion. This is in agreement with previous published studies showing an improvement in mobility after the application of

Kinesiotaping®[16,17,28,29,32,35] or cervical manipulation.[6,12,19,26,30] Changes in cervical rotation were greater in the manipulative group, but these differences were relatively small. Additionally, change improvements in cervical range of motion did not surpass the MDC which ranged between 3.6º-6.5º.[1] It is possible that greater changes in cervical range of motion are observed from multiple applications of each intervention over a longer period of time.

The current study has reported that Kinesiotaping® was as effective as cervical thrust manipulation for decreasing pain and disability in individuals presenting with mechanical neck pain. One possible mechanism by which Kinesiotaping® induced these changes could be related to the neural feedback provided to the patients which can facilitate their ability to move the cervical spine with a reduced mechanical irritation on the soft tissues. In addition, the tape may have created tension in soft tissues structures providing an afferent stimuli, facilitating a pain inhibitory mechanism, thereby reducing the pain levels of the patients.

Historically, it has been believed that the mechanisms of spinal manipulation have been primarily biomechanical in nature but recently it has been purported that the mechanisms may be neurophysiological in origin.[2-4] In fact, it was demonstrated that spinal thrust manipulation results in decreases in inflammatory cytokine[31] and an increase in endorphins.[11] Further it has been also demonstrated that cervical spine thrust manipulation increases pain pressure thresholds to a greater magnitude than a sham and control group.[14] It is also possible that spinal manipulation results in a decrease in thermal pain sensitivity.[4] The exact mechanism as to how spinal thrust manipulation exerts its effects remains to be elucidated.

There are a number of limitations in the current study that should be recognized. First, we used a sample of convenience from 1 clinic, which may not be representative of the entire population of individuals with mechanical neck pain. Second, we investigated the short-term effects of cervical thrust manipulation and Kinesiotaping® application. Therefore, we cannot make inferences that the benefits would be maintained in the long term. . In addition, therapists usually use a multi-modal approach to the management of patients with mechanical neck pain and would not solely use cervical manipulation or Kinesiotaping® as an isolated intervention. We suggest that future studies investigate if the inclusion of either procedure enhances outcomes when added to interventions with already proven effective such as active exercise.

CONCLUSION

Patients with mechanical neck pain receiving a cervical thrust manipulation or an application of Kinesiotaping® exhibited similar reduction in neck pain and disability and similar changes in active cervical range of motion. Changes in neck pain surpassed the MCID, whereas changes in disability were slightly inferior to the MCID. Finally, changes in cervical range of motion were small and not clinically meaningful since they did not surpass the MCD.

KEY POINTS

Findings: The application of Kinesio Tape or cervical thrust manipulation was equally effective for reducing pain and disability and for increasing cervical range of motion in patients with mechanical neck pain.

Implications: This study provides evidence for the application of cervical thrust manipulation and Kinesiotaping® in the management of patients with mechanical neck pain.

Caution: Changes in cervical range of motion were small and not clinically meaningful. Also, the generalizability of the results should be interpreted with caution as all patients were treated by the same therapist.

Legend of Figures

Figure 1: Kinesio Taping® Application

Figure 2: Mid-cervical spine manipulation

Figure 3: Cervico-thoracic junction manipulation

Figure 4: Flow diagram of subjects throughout the course of the study

REFERENCES

1. Audette I, Dumas JP, Côté JN, De Serres SJ. Validity and between-day reliability of the cervical range of motion (CROM) device. J Orthop Sports Phys Ther 2010; 40: 318-23
2. Bialosky JE, George SZ, Bishop MD. How spinal manipulative therapy works: why ask why? J Orthop Sports Phys Ther 2008; 38:293-5.
3. Bialosky JE, Bishop MD, Price DD et al. The mechanisms of manual therapy in the treatment of musculoskeletal pain: a comprehensive model. ManTher 2009; 14: 531-8.
4. Bialosky JE, Bishop MD, Robinson ME et al. Spinal manipulative therapy has an immediate effect on thermal pain sensitivity in people with low back pain: a randomized controlled trial. Phys Ther 2009; 89: 1292-303.
5. Borghouts JA, Koes BW, Vondeling H et al. Cost-of-illness of neck pain in The Netherlands in 1996. Pain 1999; 80: 629-36
6. Bronfort G, Evans R, Nelson B, Aker PD, Goldsmith CH, Vernon H. A randomized clinical trial of exercise and spinal manipulation for patients with chronic neck pain. Spine. 2001; 26: 788-799
7. Childs JD, Cleland JA, Elliott JM, Teyhen DS, Wainner RS, Whitman JM, Sopky BJ, Godges JJ, Flynn T. Neck Pain: A clinical practice guideline linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. J Orthop Sports Phys Ther 2008; 38: A1-A34

8. Childs JD, Flynn TW, Fritz JM, Piva SR, Whitman JM, Wainner RS, Greenman PE. Screening for vertebrobasilar insufficiency in patients with neck pain: manual therapy decision-making in the presence of uncertainty. J Orthop Sports Phys Ther 2005; 35: 300-306
9. Cleland JA, Childs JD, Whitman JM. Psychometric properties of the Neck Disability Index and Numeric Pain Rating Scale in patients with mechanical neck pain. Arch Phys Med Rehabil 2008; 89: 69-74
10. Cote P, Cassidy J, Carroll L. The factors associated with neck pain and its related disability in the Saskatchewan population. Spine 2000; 25: 1109-17
11. Degenhardt BF, Darmani NA, Johnson JC et al. Role of osteopathic manipulative treatment in altering pain biomarkers: a pilot study. J Am Osteopath Assoc 2007; 107: 387-400.
12. Evans R, Bronfort G, Nelson B, Goldsmith CH. Two-year follow-up of a randomized clinical trial of spinal manipulation and two types of exercise for patients with chronic neck pain. Spine 2002; 27: 2383-2389
13. Fejer R, Ohm-Kyvik K, Hartvigsen J. The prevalence of neck pain in the world population: a systematic critical review of the literature. Eur Spine J 2006; 15: 834-848
14. Fernández-de-las-Peñas C, Perez-de-Heredia M, Brea-Rivero M et al. Immediate effects on pressure pain threshold following a single cervical spine manipulation in healthy subjects. J Orthop Sports Phys Ther 2007; 37: 325-9.
15. Fletcher JP, Bandy WD. Intrarater reliability of CROM measurement of cervical spine active range of motion in persons with and without neck pain. J Orthop Sports Phys Ther 2008; 38: 640-645

16. García-Muro F, Rodríguez-Fernández AL, Herrero-de-Lucas A. Treatment of myofascial pain in the shoulder with Kinesio Taping: A case report. Man Ther 2010; 15: 292-295
17. González-Iglesias J, Fernández-de-las-Peñas C, Cleland JA, Huijbregts P, Gutiérrez-Vega MR. Short-term effects of cervical Kinesio Taping on pain and cervical range of motion in patients with acute whiplash injury: A Randomized Clinical Trial. J Orthop Phys Ther 2009; 39: 515-521
18. Gross A, Miller J, D'Sylva J, Burnie SJ, Goldsmith CH, Graham N, Haines T, Brønfort G, Hoving JL, COG. Manipulation or mobilisation for neck pain: a Cochrane Review. Man Ther 2010; 15: 315-333
19. Hurwitz EL, Carragee EJ, van der Velde G, Carroll LJ, Nordin M, Guzman J, Peloso PM, Holm LW, Cote P, Hogg-Johnson S, Cassidy JD, Haldeman S. Treatment of neck pain: non-invasive interventions: results of the Bone and Joint Decade 2000-2010 Task Force on neck pain and its associated disorders. Spine 2008; 33: S123-152.
20. Jensen MP, Turner JA, Romano JM, Fisher L. Comparative reliability and validity of chronic pain intensity measures. Pain 1999; 83: 157-162
21. Kase K, Wallis J. The latest Kinesiotaping method. Tokyo Ski-journal: 2002
22. Kase K, Wallis J, Kase T. Clinical Therapeutic Applications of the Kinesio Taping Method. Tokyo, Japan: Ken Ikai Co Ltd; 2003
23. Korthals B, I, Hoving JL, van Tulder MW et al. Cost effectiveness of physiotherapy, manual therapy, and general practitioner care for neck pain: economic evaluation alongside a randomised controlled trial. BMJ 2003; 326: 911

24. Macdemid JC, Walton DM, Avery S, Blanchard A, Etruw E, Mcalpine C, Goldsmith CH. Measurement properties of the neck pain Disability Index: a systematic review. J Orthop Sports Phys Ther 2009; 39: 400-417
25. Martin BI, Deyo RA, Mirza SK, Turner JA, Comstock BA, Hollingworth W, Sullivan SD. Expenditures and health status among adults with back and neck problems. JAMA 2008; 299: 656-664
26. Martínez-Segura R, Fernández-de-las-Peñas C, Ruiz-Sáez M, López-Jiménez C, Rodríguez-Blanco C. Immediate effects on neck pain and active range of motion following a single cervical HVLA manipulation in subjects presenting with mechanical neck pain: a randomized controlled trial. J Man Physiol Ther 2006; 29: 511-517
27. Mintken PE, DeRosa C, Little T, Smith B. AAOMPT clinical guidelines: A model for standardizing manipulation terminology in physical therapy practice. J Orthop Sports Phys Ther 2008; 38: A1-6.
28. Murray H, Husk LJ. Effect of Kinesiotaping on proprioception in the ankle (abstract). J Orthop Sports Phys Ther 2001; 31: A37
29. Osterhues DJ. The use of Kinesiotaping in the management of traumatic patella dislocation: A case study. Physiother Theor Pract 2004; 20: 267-170
30. Puentedura EJ, Landers MR, Cleland JA, Mintken PE, Huijbregts P, Fernández-de-las-Peñas C. Thoracic spine manipulation versus cervical spine thrust manipulation in patients with acute neck pain: a randomized clinical trial. J Orthop Sports Phys Ther 2011; 41: 208-220
31. Teodorczyk-Injeyan JA, Injeyan HS, Ruegg R. Spinal manipulative therapy reduces inflammatory cytokines but not substance P production in normal subjects. J Manipulative Physiol Ther 2006; 29: 14-21.

32. Thelen MD, Dauber JA, Stoneman PD. The clinical efficacy of kinesio tape for shoulder pain: a randomized, double-blinded, clinical trial. J Orthop Phys Ther 2008; 38: 389-395

33. Vernon H, Mior S. The Neck Disability Index: a study of reliability and validity. J Manipulative Physiol Ther 1991; 14: 409-415

34. Werneke MW, Hart DL, Cook D. A descriptive study of the centralization phenomenon: a prospective analysis. Spine 1999; 24: 676-683

35. Yoshida A, Kahanov L. The effect of Kinesiotaping on lower trunk range of motions. Res Sports Med 2007; 15: 103-112

36. Zajt-Kwiatkowska J, Rajkowska-Labon E, Skrobot W, Bakula S, Szamotulska J. Application of kinesio taping for treatment of sport injuries. Research Year-Book 2007; 13: 130-134

Table 1: Baseline demographics for both groups*

	Manipulative Group	Kinesio Tape Group	P values
Gender (Male / Female)	19/17	21/19	0.906
Age (years)	44 ± 10	46 ± 9	0.312
Duration of symptoms (months)	75 ± 18	82 ± 19	0.479
Neck pain**	5.0 ± 1.9	5.2 ± 1.4	0.456
Neck Disability Index***	22.5 ± 4.3	21.4 ± 2.3	0.151
Cervical range of motion (degrees)			
Flexion	56.0 ± 10.7	55.8 ± 7.8	0.955
Extension	56.9 ± 12.9	53.1 ± 19.9	0.333
Right lateral-flexion	39.0 ± 8.6	39.0 ± 8.4	0.978
Left lateral-flexion	39.6 ± 7.5	38.9 ± 6.4	0.653
Right rotation	70.6 ± 12.3	71.3 ± 12.6	0.809
Left rotation	71.1 ± 13.7	76.0 ± 12.7	0.108

* Data are mean ± SD except for gender.
** Measured with a 11-point numerical pain rate scale (0, no pain; 10, worst pain imaginable)
*** Range of score is 0-50 with higher scores meaning greater disability

Table 2: Baseline, 7-days post-treatment, and change scores for neck pain, disability, and cervical range of motion

Outcome Group	Baseline	7-days post-treatment	Within Group Change Scores	Between-Group Change Scores
Pain (0-10 points)				
Kinesio Tape	5.2 ± 1.4	2.7 ± 1.2	-2.5 (-2.9, -2.0)	0.2 (0.0, 0.5)
Manipulative	5.0 ± 1.9	2.7 ± 1.6	-2.3 (-3.0, -1.1)	
Neck Disability Index (0-50 points)				
Kinesio Tape	21.4 ± 2.3	15.4 ± 1.8	-6.0 (-6.8, -5.2)	0.3 (-1.3, 1.9)
Manipulative	22.5 ± 4.3	16.8 ± 3.9	-5.7 (-7.2, -4.1)	
Cervical Flexion (deg)				
Kinesio Tape	55.8 ± 7.8	58.6 ± 9.5	2.8 (0.1, 5.5)	2.0 (-2.1, 6.0)
Manipulative	56.0 ± 10.7	56.8 ± 7.6	0.8 (-4.0, 2.4)	
Cervical Extension (deg)				
Kinesio Tape	53.1 ± 19.9	57.0 ± 15.2	3.9 (2.6, 10.3)	1.4 (-6.8, 9.7)
Manipulative	56.9 ± 12.9	62.2 ± 9.9	5.3 (2.0, 8.6)	
Cervical Right Lateral Flexion (deg)				
Kinesio Tape	39.0 ± 8.4	43.9 ± 7.6	4.9 (2.2, 7.6)	1.4 (-6.7, 9.8)
Manipulative	39.0 ± 8.6	45.3 ± 7.7	6.3 (4.1, 8.5)	
Cervical Left Lateral Flexion (deg)				
Kinesio Tape	38.9 ± 6.4	42.8 ± 6.6	3.9 (1.9, 4.7)	0.9 (-2.1, 4.0)
Manipulative	39.6 ± 7.5	42.6 ± 7.2	3.0 (0.4, 5.4)	
Cervical Right Rotation (deg)				
Kinesio Tape	71.3 ± 12.6	72.0 ± 12.5	0.7 (-3.1, 4.6)	6.8 (1.8, 11.7)*
Manipulative	70.6 ± 12.3	78.1 ± 9.8	7.5 (4.3, 10.7)	
Cervical Left Rotation (deg)				
Kinesio Tape	76.0 ± 12.7	76.8 ± 10.4	0.7 (-2.4, 3.9)	7.0 (2.5, 11,5)*
Manipulative	71.1 ± 13.7	78.8 ± 9.6	7.7 (4.3, 11.1)	

Values are expressed as mean ± standard deviation for Baseline and immediate post-treatment means and as mean (95% confidence interval) for within- and between-group change scores / * Significant Group * Time interaction (ANOVA, $P < 0.01$)

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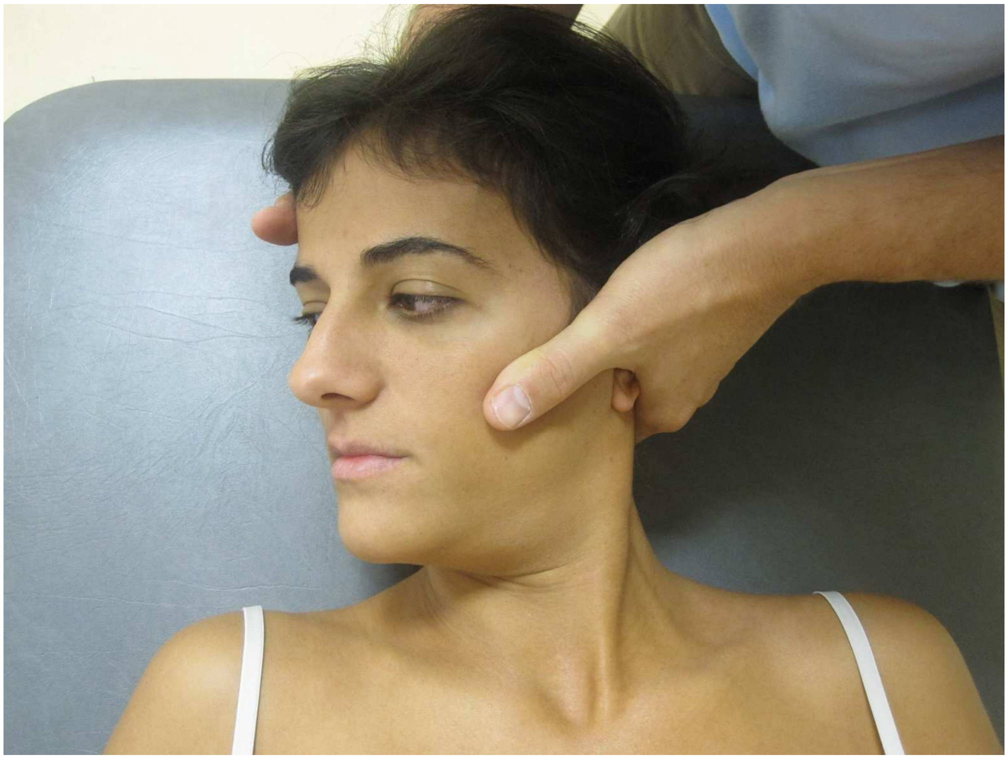

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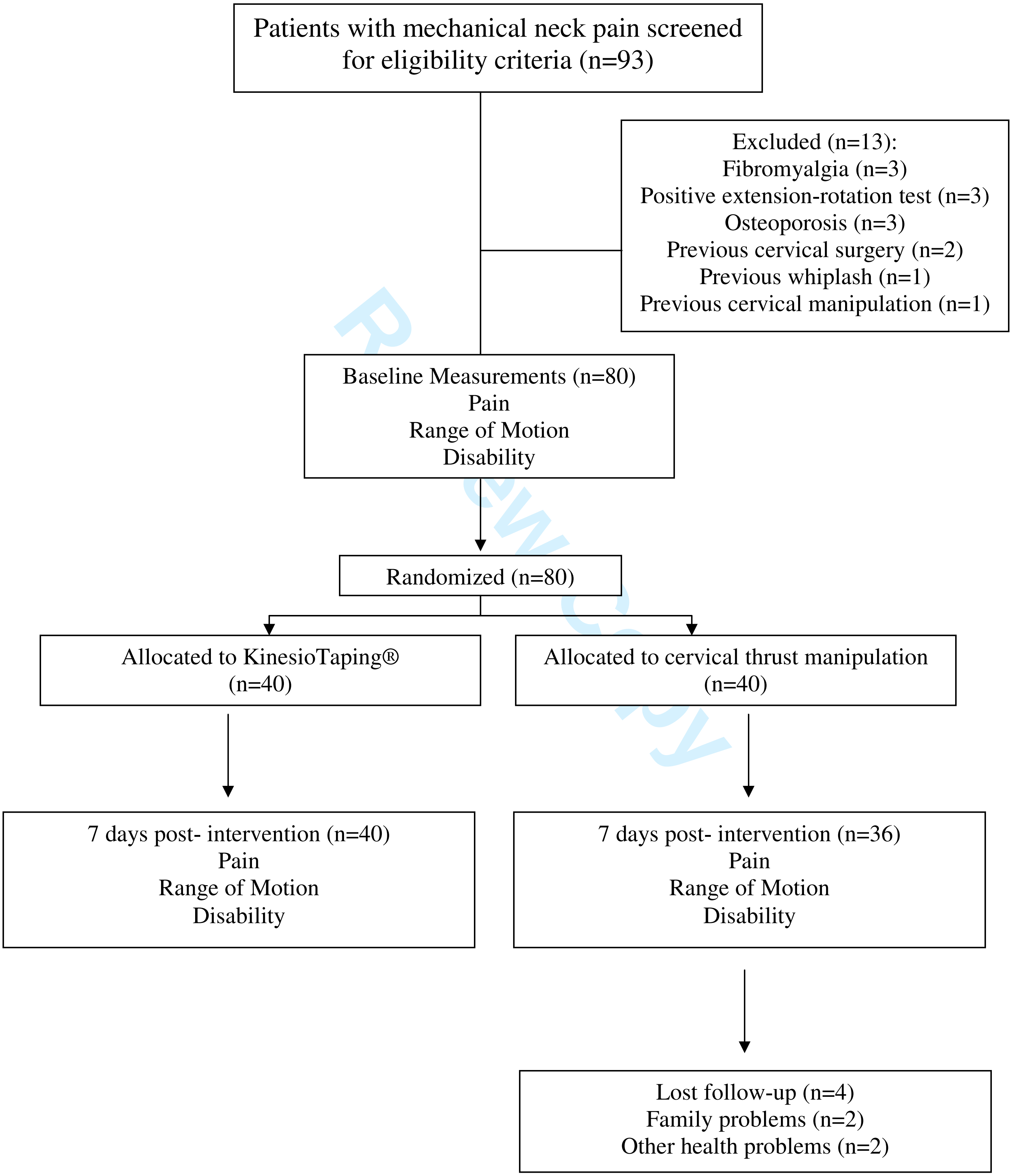
Figure 4: Flow diagram of patients throughout the course of the study



IV. Pain Intensity, Physical Impairment and Pain-Related Fear to Function in Patients with chronic Mechanical Cervical Pain.

Autores: Saavedra-Hernández, Castro-Sánchez AM, Cuesta-Vargas AI, Cleland J, Fernández-de-las-Peñas C, Arroyo-Morales M. Amercian Journal Physical Medicne & Rehabilitation. En Revisión.

Clinical Rehabilitation

SHORT-TERM EFFECTS OF SPINAL THRUST JOINT MANIPULATION IN PATIENTS WITH CHRONIC MECHANICAL NECK PAIN: A RANDOMIZED CLINICAL TRIAL

Journal:	*Clinical Rehabilitation*
Manuscript ID:	CRE-2012-2228
Manuscript Type:	Original Article
Keywords:	manipulation, Neck pain, pain, Disability

Abstract:	Objective: To compare the effects of an isolated application of cervical spine joint manipulation (TJM) vs. the application of cervical, cervico-thoracic junction and thoracic spine TJM on neck pain, disability and cervical range of motion (CROM) in chronic mechanical neck pain. Design: Randomized clinical trial. Setting: Clinical practice. Participants: Eighty-two patients (41 females) with chronic mechanical neck pain. Interventions: Patients were randomly assigned to a cervical spine TJM group or a clinical manipulative group who received 3 mid-cervical, cervico-thoracic, and thoracic TJM. Measurements: Neck pain intensity (11-point numeric pain rating scale), self-reported disability (Neck Disability Index), and CROM were collected at baseline and one week after the intervention by an assessor blinded to the treatment allocation of the patients. Results: A significant Group*Time interaction for NDI (P=0.022), but not for neck pain (P=0.612) was found: patients in the clinical manipulative group exhibited greater reduction in disability than those who received the cervical spine TJM, whereas both groups experienced similar decrease in neck pain. Patients in both groups experienced similar increases in CROM (P>0.40). No effect of gender was observed (P>0.299). Conclusions: The application of cervical TJM alone is equally effective for reducing neck pain and for improving CROM than the application of cervical TJM combined with cervico-thoracic and thoracic TJM in mechanical neck pain. The reduction of disability was greater in patients receiving clinical combination of spinal TJM. Changes in neck pain and disability surpassed the minimal clinically important difference, but the changes in CROM were not clinically meaningful.

SHORT-TERM EFFECTS OF SPINAL THRUST JOINT MANIPULATION IN PATIENTS WITH CHRONIC MECHANICAL NECK PAIN: A RANDOMIZED CLINICAL TRIAL

ABSTRACT

Objective: To compare the effects of an isolated application of cervical spine joint manipulation (TJM) vs. the application of cervical, cervico-thoracic junction and thoracic spine TJM on neck pain, disability and cervical range of motion (CROM) in chronic mechanical neck pain. **Design:** Randomized clinical trial. **Setting:** Clinical practice. **Participants:** Eighty-two patients (41 females) with chronic mechanical neck pain. **Interventions:** Patients were randomly assigned to a cervical spine TJM group or a clinical manipulative group who received 3 mid-cervical, cervico-thoracic, and thoracic TJM. **Measurements:** Neck pain intensity (11-point numeric pain rating scale), self-reported disability (Neck Disability Index), and CROM were collected at baseline and one week after the intervention by an assessor blinded to the treatment allocation of the patients. **Results:** A significant Group*Time interaction for NDI (P=0.022), but not for neck pain (P=0.612) was found: patients in the clinical manipulative group exhibited greater reduction in disability than those who received the cervical spine TJM, whereas both groups experienced similar decrease in neck pain. Patients in both groups experienced similar increases in CROM (P>0.40). No effect of gender was observed (P>0.299). **Conclusions:** The application of cervical TJM alone is equally effective for reducing neck pain and for improving CROM than the application of cervical TJM combined with cervico-thoracic and thoracic TJM in mechanical neck pain. The reduction of disability was greater in patients receiving clinical combination of spinal TJM. Changes in neck pain and disability surpassed the minimal clinically important difference, but the changes in CROM were not clinically meaningful.

Key Words: Cervical spine, neck pain, manipulation, clinical trial.

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Key Words: Cervical spine, neck pain, manipulation, clinical trial.

INTRODUCTION

Mechanical neck pain constitutes a significant societal burden since it results in substantial disability and costs (1,2). It has been reported that the prevalence of neck pain is almost as high as low back pain (3). The 1-year prevalence for neck pain has been reported to range between 16.7% and 75.1% (37.2%) (4).

Physical therapy is the first management approach for patients with insidious mechanical neck pain with manual therapy often being a preferred intervention (5). In fact, a common clinical approach for therapists is to incorporate manual therapy interventions directed to the cervical spine into the management of individuals with neck pain. These manual therapy techniques include passive joint non-thrust mobilization and thrust joint manipulation (TJM).

Although a number of randomized controlled clinical trials supports the application of either cervical (6-9) or thoracic (10-13) spine TJM in individuals with mechanical neck pain; recent reviews have concluded that low quality evidence exists for the use of cervical (14) or thoracic (15) thrust interventions in isolation. Further, preliminary studies have developed clinical prediction rules to identify subgroups of patients with neck pain who were more likely to benefit from thoracic (16) or cervical (17) TJM. Nevertheless, patients fulfilling one of these rules, e.g. thoracic spine TJM can also benefit from the other intervention, that is, cervical spine TJM (18).

One of the main limitations of previous studies is that simply using just cervical or thoracic spine TJM may not be representative of usual clinical practice, as therapists usually apply different manipulative interventions at different levels for the management of patients with mechanical neck pain (19). We do not know if the application of different spinal TJM would increase the effect of the application of only one intervention. Therefore, the purpose of this randomized controlled trial was to compare the effects of an isolated application of cervical spine TJM vs. the application of a clinical combination of cervical, cervico-thoracic and thoracic spine TJM on neck pain, disability and cervical range of motion (CROM) in individuals with chronic mechanical neck pain.

METHODS

Participants

A randomized single blind clinical trial was conducted. Patients with a primary complaint of bilateral chronic mechanical neck pain who were referred for physical therapy at a private clinic in Almeria (Spain) were recruited for this study. Mechanical neck pain was defined as neck pain provoked by neck postures, cervical movement or manual palpation of the neck musculature. Patients were screened for any signs of Vertebrobasilar Insufficiency (VBI), e.g., nystagmus, gait disturbances, Horner's syndrome, and underwent screening for upper cervical spine ligamentous instability through Sharp-Purser test, alar ligament stress test, and transverse ligament tests. Exclusion criteria included the following: 1) contraindication to cervical TJM (e.g. fracture, osteoporosis, positive extension-rotation test, any symptom of Vertebrobasilar Insufficiency; 2) history of whiplash; 3) history of cervical spine surgery; 4) diagnosis of cervical radiculopathy or myelopathy; 5) diagnosis of fibromyalgia syndrome; 6) having previously undergone spinal manipulative therapy; or, 7) less than 18 or greater than 55 years of age. Informed consent was obtained from each patient before entering the study, which was conducted in accordance with the Helsinki Declaration. The study was approved by the ethics and research committee of the University of Almeria.

Study Protocol

Patients provided demographic and clinical information and completed a number of self-report measures at baseline, which included a numeric pain rating scale (NPRS) for assessing the intensity of the pain (20), the Neck Disability Index (NDI) to measure self-perceived disability (21), and a body diagram to assess the distribution of pain (22). Once patients completed the self-report measures, cervical range of motion (CROM) testing was assessed. The NPRS (range: 0, no pain; 10, maximum pain) was used to assess the intensity of neck pain at rest. The minimal detectable change (MDC) and the minimal clinically important difference (MCID) for the NPRS in individuals with neck pain have been reported to be 1.3 and 2.1 points, respectively (23). The NDI consists of 10 questions addressing functional activities (personal care, lifting, reading, work, driving, sleeping, and recreational activities) as well as pain intensity, concentration, and headache (21). There are 6 potential responses for each question, ranging from no disability (0) to total disability (5). The NDI is scored from 0 to 50, with higher scores indicating greater disability. The MDC and the MCID for the NDI have been estimated on 5 and 7 points out of 50, respectively (24). Cervical range of motion (CROM) testing was assessed with the patient sitting following previous guidelines (25,26). Patients were asked to move their head as far as possible without pain in a standardized manner: flexion, extension, right and left lateral flexion, right and left rotation. It has been reported that the standard error of measurement (SEM) across the 6 cervical movements ranged from 1.6º to 2.8º, whereas the MDC ranged from 3.6º to 6.5º (27).

All outcomes were collected at baseline and 7 days after the intervention by an assessor blinded to the treatment allocation of the patients.

Allocation

Following the baseline examination, patients were randomly assigned to receive only cervical TJM (cervical manipulative group) or several manipulative interventions (clinical manipulative group). Concealed allocation was performed using a computer-generated randomized table of numbers created prior to the start of data collection by a researcher not involved in either recruitment or treatment of the patients. Sequentially numbered index cards with the random assignment were prepared. The index cards were folded and placed in sealed opaque envelopes. A second therapist, blinded to baseline examination findings, opened the envelope and proceeded with treatment according to the group assignment.

Manipulative Interventions

As we wanted to mimic common clinical practice for the management of patients with mechanical neck pain, clinicians chose which levels of the spine to manipulate in the cervical, cervico-thoracic or thoracic spine based on the following clinical findings: presence of hypomobility (abnormal end-feel and increased tissue resistance) combined with pain provocation during the test. All treatments were applied by 2 experienced therapists with a 5-year certification in spinal manipulative therapy after completion of their physical therapy degree and more than 10 years of clinical experience with patients. In the cervical manipulative group, patients received only the cervical spine TJM, and in the clinical manipulation group, they received 3 TJM techniques targeted at the cervical spine, cervico-thoracic junction and upper thoracic spine region. All patients received the intervention on the day of their initial examination. The techniques took less than 5min and were conducted as follows (28):

A) Upper thoracic spine manipulation: patients were supine with the arms crossed over the chest and hands placed over the shoulders. The therapist placed their chest at the level of the patient's middle thoracic spine and grasped the patient's elbows. Flexion of the thoracic spine was introduced until slight tension was felt in the tissues at the contact point. A distraction TJM in an upward direction was applied (**Fig. 1**). If no popping sound was heard on the first attempt, the therapist repositioned the patient, and performed a second manipulation. A maximum of 2 attempts were allowed on each patient.

B) Cervico-thoracic junction manipulation: this technique was applied bilaterally. Here we describe the procedure for a right C7-T1 TJM, that is, the contact was on the left side of the cervico-thoracic junction. The patient was prone with the head and neck rotated to the right. The therapist stood on the right side of the patient facing in a cephalic direction. The therapist's left hand makes contact with the thumb on the left side of the spinous process of T1. The therapist's right hand supports the head of the patient. The head/neck is gently laterally-flexed to the left, until slight tension is palpated in the tissues. A high-velocity low-amplitude thrust was applied toward the patients' right side (**Fig. 2**). Again, a maximum of 2 attempts were allowed for each side.

C) *Mid-cervical spine manipulation*: the subject was supine with the cervical spine in a neutral position. The index finger of the therapist applied a contact over the posterior-lateral aspect of the zygapophyseal joint of C3. The therapist cradled the patient's head with the other hand. Ipsilateral side-flexion and contralateral rotation to the targeted side was introduced until slight tension was perceived in the tissues at the contact point (**Fig. 3**). A high-velocity low-amplitude thrust manipulation was directed upward and medially in the direction of the patient's contralateral eye. Similarly, a maximum of 2 attempts were allowed to obtain cavitation.

Treatment Side Effects

Patients were asked to report any adverse event that they experienced after the intervention and during a one week follow-up. In this study, an adverse event was defined as sequelae of medium-term in duration with any symptom perceived as distressing and unacceptable to the patient and required further treatment.

Statistical Analysis

Data were analyzed with SPSS© version 18.0 and it was conducted following intention-to-treat analysis. When post-intervention data were missing, baseline scores were used. Baseline demographic and clinical variables were examined between groups using independent Student t-tests for continuous data and χ^2 tests of independence for categorical data. Separate mixed-model ANCOVA were used to examine the effects of treatment on neck pain and self-reported disability as dependent variables, with group as the between-subjects variable, time as within-subjects variable and gender as covariate. A 3x2 mixed-model ANCOVA was used to evaluate the differences in cervical range of motion for lateral-flexion and rotation motion with side and time as the within-subjects variable, group as the between-subjects variable and gender as covariate. Finally, a 2x2 ANCOVA with group as the between-subjects variable, time as within-subjects variable and gender as covariate was again used to evaluate the differences in flexion/extension. The hypothesis of interest was the Group * Time interaction at an *a priori* alpha-level equal to 0.05.

RESULTS

Ninety consecutive individuals were screened for eligibility criteria. Eighty-two patients (mean ± SD age: 45 ± 9 year; 50% female) satisfied the eligibility criteria, agreed to participate, and were randomized into cervical manipulative (n=41) or clinical manipulative (n=41) group. Reasons for ineligibility can be found in **Figure 4**, which provides a flow diagram of patient recruitment and retention. Baseline features between both groups were similar for all variables at the beginning of the study (**Table 1**).

The mixed model ANCOVA revealed a statistically significant Group * Time interaction for NDI ($F = 5.450$; $P = 0.022$), but not for neck pain ($F = 0.259$; $P = 0.612$) as dependent variables: patients who received the clinical combination of spinal TJM exhibited greater reduction in disability than those who received only the cervical spine TJM whereas both groups experienced similar decreases in neck pain. No effect of gender for NDI ($F = 0.355$; $P = 0.553$) or neck pain ($F = 0.219$; $P = 0.641$) was found. **Table 2** shows data at baseline, post-intervention, within-group and between-group differences with associated 95% CI for neck pain and self-reported disability.

The 3X2 mixed ANCOVA did not find significant Group * Time interaction for cervical flexion ($F = 0.697$, $P = 0.406$), extension ($F = 0.275$, $P = 0.602$), lateral-flexion ($F = 0.485$; $P = 0.487$) or rotation ($F = 0.297$; $P = 0.587$) range of motion: patients in both groups experienced similar increases in cervical range of motion. Again, no effect of gender was observed for any cervical range of motion: flexion: $F = 0.468$, $P = 0.496$; extension: $F= 1.004$, $P= 0.299$; lateral-flexion: $F = 0.474$, $P = 0.493$; rotation: $F = 0.283$, $P = 0.596$. **Table 2** summarizes baseline, post-intervention, within-group and between-group differences with associated 95% CI for cervical range of motion.

In this study, 2 patients reported a minor side effects: 1 patient (2.5%) who received the cervical thrust manipulation experienced an increased neck pain the day after the intervention, and 1 patient (2.5%) who received the clinical combination of spine thrust manipulation exhibited increased neck fatigue after the treatment. These minor post-treatment symptoms resolved spontaneously within 24 hours of onset.

DISCUSSION

Our results showed that the application of cervical TJM alone was equally effective in reducing neck pain and improving CROM as the application of cervical TJM combined with cervico-thoracic junction and thoracic TJM in patients with chronic mechanical neck pain. In addition, those patients receiving the clinical combination of spinal TJM exhibited greater reduction of self-reported disability than those receiving the cervical spine TJM alone.

This randomized clinical trial further supports the effectiveness of spinal TJM for decreasing neck pain in individuals with mechanical neck pain which agrees with previous studies (6-15). In fact, the decrease in neck pain intensity in both groups was statistically significant and the mean decrease surpassed the MCID which has been reported to be 2.1 points (23). Nevertheless, the lower bound estimates for the 95% confidence intervals fall above the previously reported MCID of 2.1 in both groups so this assumption should be considered with caution since the reduction of neck pain in several patients maybe lower. Further both groups also exhibited similar small increases in CROM; however, most change improvements in CROM did not surpass the MDC which ranged between 3.6º and 6.5º (27). It is probable that changes in CROM may be greater and more clinically meaningful after multiple spinal TJM over a longer period of time. In fact, a recent study has demonstrated that consecutive application of lumbar spine TJM induces better long-term outcomes in patients with chronic low back pain (29).

We also found that patients receiving the 3 spinal TJM exhibited greater reduction in self-reported disability than those receiving the cervical spine TJM alone. In fact, mean changes and their confidence intervals observed in the clinical manipulative group surpassed the MCID of 7 points established for NDI (27), whereas changes in the cervical spine group did not surpass the MCID. It is possible that the application of thoracic and cervico-thoracic junction TJM in addition to the cervical spine TJM have a cumulative effect on outcomes. It is also possible that consecutive applications of spinal TJM would induce greater reduction in disability.

While a complete review of the neuro-physiological mechanisms of spinal TJM is beyond the scope of this study, some aspects should be considered. It has been historically believed that the mechanisms of spinal TJM should be primarily biomechanical in nature, but it has been recently demonstrated that these mechanisms may also be neurophysiological in origin (30,31). For instance, it has been shown that spinal manipulation decreases inflammatory cytokines (32) and increases in endorphins (33). Further it has been also demonstrated that cervical spine (34) or cervico-thoracic junction (35) TJM increases pain pressure thresholds to a greater magnitude than sham and control groups. These neurophysiological effects may be involved in the decrease in neck pain and disability found in the current study after the application of spinal TJM. Nevertheless, the fact that patients receiving the clinical combination of spinal TJM exhibited similar decreases in neck pain than those receiving only the cervical TJM suggests that the inclusion of a greater number of TJM does not increase the short-term effect on pain. We found that patients receiving a greater number of TJM (clinical manipulative group) only demonstrated better outcomes on disability.

There are a number of limitations that should be considered with respect to our study. First, we used a sample of convenience from only one clinic, which may not be representative of the general population of patients with chronic mechanical neck pain. Future studies should investigate the effects of spinal TJM including patients with both acute and chronic neck pain and treated by different clinicians. Second, we investigated the short-term effects of spinal TJM. We cannot infer that the benefits observed would be maintained in the long term. As it has been pointed out, it is plausible that consecutive applications induce greater effects (29). Third, management of patients with mechanical neck pain usually involves a multi-modal approach and not only the use of spinal TJM as isolated interventions. We would recommend that future studies investigate if the inclusion of spinal TJM enhances outcomes when added to interventions which have already been proven effective, such as active exercise (36).

CONCLUSION

We found that the application of cervical TJM alone was equally effective in reducing neck pain and in improving CROM when compared to the application of cervical TJM combined with cervico-thoracic junction and thoracic TJM in patients with chronic mechanical neck pain. We also found that the reduction of disability was greater in those patients receiving the clinical combination of spinal TJM. Changes in neck pain and disability surpassed the MCID, whereas changes in CROM were not clinically meaningful since they did not surpass the MCID.

CLINICAL MESSAGES

This randomized controlled trial investigated changes in pain and disability outcomes in patients with mechanical neck pain who received a cervical spine manipulation alone or in combination with C7-T1 and thoracic spine thrust manipulation.

This study found that the application of cervical manipulation alone is equally effective for reducing neck pain and for improving cervical range of motion than the application of cervical combined with cervico-thoracic junction and thoracic spine thrust manipulation in chronic mechanical neck pain. The reduction of disability was greater in patients receiving clinical combination of spinal thrust manipulation

REFERENCES

1. Borghouts JA, Koes BW, Vondeling H et al. Cost-of-illness of neck pain in The Netherlands in 1996. Pain 1999; 80: 629-36
2. Cote P, Cassidy J, Carroll L. The factors associated with neck pain and its related disability in the Saskatchewan population. Spine 2000; 25: 1109-17
3. Martin BI, Deyo RA, Mirza SK, Turner JA, Comstock BA, Hollingworth W, Sullivan SD. Expenditures and health status among adults with back and neck problems. JAMA 2008; 299: 656-664
4. Fejer R, Ohm-Kyvik K, Hartvigsen J. The prevalence of neck pain in the world population: a systematic critical review of the literature. Eur Spine J 2006; 15: 834-848
5. Childs JD, Cleland JA, Elliott JM, Teyhen DS, Wainner RS, Whitman JM, Sopky BJ, Godges JJ, Flynn T. Neck Pain: A clinical practice guideline linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. J Orthop Sports Phys Ther 2008; 38: A1-A34
6. Bronfort G, Evans R, Nelson B, Aker PD, Goldsmith CH, Vernon H. A randomized clinical trial of exercise and spinal manipulation for patients with chronic neck pain. Spine 2001; 26: 788-799
7. Martínez-Segura R, Fernández-de-las-Peñas C, Ruiz-Sáez M, López-Jiménez C, Rodríguez-Blanco C. Immediate effects on neck pain and active range of motion following a single cervical HVLA manipulation in subjects presenting with mechanical neck pain: a randomized controlled trial. J Man Physiol Ther 2006; 29: 511-517
8. Evans R, Bronfort G, Nelson B, Goldsmith CH. Two-year follow-up of a randomized clinical trial of spinal manipulation and two types of exercise for patients with chronic neck pain. Spine 2002; 27: 2383-2389
9. Hurwitz EL, Carragee EJ, van der Velde G, Carroll LJ, Nordin M, Guzman J, Peloso PM, Holm LW, Cote P, Hogg-Johnson S, Cassidy JD, Haldeman S. Treatment of neck

pain: non-invasive interventions: results of the Bone and Joint Decade 2000-2010 Task Force on neck pain and its associated disorders. Spine 2008; 33: S123-152.

10. González-Iglesias J, Fernández-de-las-Peñas C, Cleland JA, Alburquerque-Sendín F, Palomeque-del-Cerro L, Méndez-Sánchez R. Inclusion of thoracic thrust manipulation into an electrotherapy program for the management of patients with acute mechanical neck pain: A randomized clinical trial. Man Ther 2009; 14: 306-313
11. González-Iglesias J, Fernández-de-las Peñas C, Cleland J, Gutiérrez-Vega M. Thoracic spine manipulation for the management of patients with neck pain: A randomized clinical trial. J Orthop Sports Phys Ther 2009; 39: 20-27
12. Krauss J, Creighton D, Ely JD, Podlewska-Ely J. The immediate effects of upper thoracic translatoric spinal manipulation on cervical pain and range of motion: a randomized clinical trial. J Man Manip Ther 2008; 16: 93-99
13. Lau HM, Wing Chiu TT, Lam TH. The effectiveness of thoracic manipulation on patients with chronic mechanical neck pain: a randomized controlled trial. Man Ther 2011; 16: 141-7
14. Gross A, Miller J, D'Sylva J, Burnie SJ, Goldsmith CH, Graham N, Haines T, Brønfort G, Hoving JL, COG. Manipulation or mobilisation for neck pain: a Cochrane Review. Man Ther 2010; 15: 315-333
15. Cross KM, Kuenze C, Grindastaff TL, Hertel J. Thoracic spine thrust manipulation improves pain, range of motion, and self-reported function in patients with mechanical neck pain: a systematic review. J Orthop Sports Phys Ther 2011; 41: 633-42.
16. Cleland JA, Childs JD, Fritz JM, Whitman JM, Eberhart SL. Development of a clinical prediction rule for guiding treatment of a subgroup of patients with neck pain: use of thoracic spine manipulation, exercise, and patient education. Phys Ther 2007; 87: 9-23.
17. Tseng YL, Wang WT, Chen WY, Hou TJ, Chen TC, Lieu FK. Predictors for the immediate responders to cervical manipulation in patients with neck pain. Man Ther 2006; 11: 306-15

18. Puentedura EJ, Landers MR, Cleland JA, Mintken PE, Huijbregts P, Fernández-de-las-Peñas C. Thoracic spine manipulation versus cervical spine thrust manipulation in patients with acute neck pain: a randomized clinical trial. J Orthop Sports Phys Ther 2011; 41: 208-220

19. Fernández-de-las-Peñas C, Cleland JA, Glynn P. Spinal manipulative therapy: from research to clinical practice. Crit Rev Phys Rehabil Med 2008; 20 : 39-53

20. Jensen MP, Turner JA, Romano JM, Fisher L. Comparative reliability and validity of chronic pain intensity measures. Pain 1999; 83: 157-162

21. Vernon H, Mior S. The Neck Disability Index: a study of reliability and validity. J Manipulative Physiol Ther 1991; 14: 409-415

22. Werneke MW, Hart DL, Cook D. A descriptive study of the centralization phenomenon: a prospective analysis. Spine 1999; 24: 676-683

23. Cleland JA, Childs JD, Whitman JM. Psychometric properties of the Neck Disability Index and Numeric Pain Rating Scale in patients with mechanical neck pain. Arch Phys Med Rehabil 2008; 89: 69-74

24. Macdemid JC, Walton DM, Avery S, Blanchard A, Etruw E, Mcalpine C, Goldsmith CH. Measurement properties of the neck pain Disability Index: a systematic review. J Orthop Sports Phys Ther 2009; 39: 400-417

25. De-la-Llave-Rincón AI, Fernández-de-las-Peñas C, Palacios-Ceña D, Cleland JA. Increased forward head posture and restricted cervical range of motion in patients with carpal tunnel syndrome. J Orthop Sports Phys Ther 2009; 39: 658-64

26. Fernández-de-las-Peñas C, Alonso-Blanco C, Cuadrado ML, Pareja JA. Forward head posture and neck mobility in chronic tension-type headache: a blinded, controlled study. Cephalalgia 2006; 26: 314-9

27. Audette I, Dumas JP, Côté JN, De Serres SJ. Validity and between-day reliability of the cervical range of motion (CROM) device. J Orthop Sports Phys Ther 2010; 40: 318-23

28. Mintken PE, DeRosa C, Little T, Smith B. AAOMPT clinical guidelines: A model for standardizing manipulation terminology in physical therapy practice. J Orthop Sports Phys Ther 2008; 38: A1-6.

29. Senna MK, Machaly SA. Does maintained spinal manipulation therapy for chronic nonspecific low back pain result in better long-term outcome? Spine 2011; 36: 1427-37

30. Bialosky JE, Bishop MD, Price DD et al. The mechanisms of manual therapy in the treatment of musculoskeletal pain: a comprehensive model. ManTher 2009; 14: 531-8.

31. Bialosky JE, George SZ, Bishop MD. How spinal manipulative therapy works: why ask why? J Orthop Sports Phys Ther 2008; 38:293-5.

32. Teodorczyk-Injeyan JA, Injeyan HS, Ruegg R. Spinal manipulative therapy reduces inflammatory cytokines but not substance P production in normal subjects. J Manipulative Physiol Ther 2006; 29: 14-21

33. Degenhardt BF, Darmani NA, Johnson JC et al. Role of osteopathic manipulative treatment in altering pain biomarkers: a pilot study. J Am Osteopath Assoc 2007; 107: 387-400.

34. Fernandez-de-las-Penas C, Perez-de-Heredia M, Brea-Rivero M et al. Immediate effects on pressure pain threshold following a single cervical spine manipulation in healthy subjects. J Orthop Sports Phys Ther 2007; 37: 325-9

35. Fernández-de-las-Peñas C, Alonso-Blanco C, Cleland JA, Rodríguez-Blanco C, Alburquerque-Sendín F. Changes in pressure pain thresholds over C5-C6 zygapophyseal joint following a cervico-thoracic junction manipulation in healthy subjects. J Manipulative Physiol Ther 2008; 31: 332-7

36. Miller J, Gross A, D'Sylva J, et al. Manual therapy and exercise for neck pain: A systematic review. Man Ther 20120; 15: 334-354.

Legend of Figures

Figure 1: Upper thoracic spine manipulation

Figure 2: Cervico-thoracic junction manipulation

Figure 3: Mid-cervical spine manipulation

Figure 4: Flow diagram of subjects throughout the course of the study

Table 1: Baseline demographics for both groups*

	Clinical Manipulative Group (n=41)	Cervical Manipulative Group (n=41)	P values
Gender (Male / Female)	21/20	20/21	0.906
Age (years)	45 ± 8	44 ± 9	0.812
Duration of symptoms (months)	83 ± 7	77 ± 7	0.684
Neck pain**	4.9 ± 1.1	4.8 ± 1.5	0.903
Neck Disability Index***	22.2 ± 11.6	23.7 ± 4.1	0.392
Cervical range of motion (degrees)			
Flexion	54.4 ± 11.0	55.6 ± 10.7	0.608
Extension	56.0 ± 7.6	56.8 ± 8.7	0.711
Right lateral-flexion	37.9 ± 5.3	39.1 ± 8.6	0.426
Left lateral-flexion	38.5 ± 5.4	39.7 ± 7.6	0.409
Right rotation	68.0 ± 10.8	70.6 ± 12.4	0.423
Left rotation	71.2 ± 11.6	71.4 ± 13.7	0.951

* Data are mean ± SD except for gender.
** Measured with a 11-point numerical pain rate scale (0, no pain; 10, worst pain imaginable)
*** Range of score is 0-50 with higher scores meaning greater disability

Table 2: Baseline, 7-days post-treatment, and change scores for neck pain, disability, and cervical range of motion

Outcome Group	Baseline	7-days post-treatment	Within Group Change Scores	Between-Group Change Scores
Pain (0-10 points)				
Clinical Manipulative	4.9 ± 1.1	2.7 ± 1.5	-2.2 (-2.8, -1.8)	0.1 (0.0, 0.3)
Cervical Manipulative	4.8 ± 1.5	2.7 ± 1.3	-2.1 (-3.5, -1.4)	
Neck Disability Index (0-50 points)				
Clinical Manipulative	22.2 ± 11.6	11.6 ± 8.9	-10.6 (-13.1, -7.9)	3.7 (1.5, 6.8)*
Cervical Manipulative	23.7 ± 4.1	16.8 ± 3.9	-6.9 (-8.3, -5.3)	
Cervical Flexion (deg)				
Clinical Manipulative	54.4 ± 11.0	56.8 ± 9.0	2.4 (1.2, 4.3)	0.5 (-2.3, 2.5)
Cervical Manipulative	55.6 ± 10.7	57.5 ± 7.8	1.9 (0.5, 3.6)	
Cervical Extension (deg)				
Clinical Manipulative	56.0 ± 7.6	60.0 ± 10.8	4.0 (2.1, 6.3)	1.8 (-2.8, 4.8)
Cervical Manipulative	56.8 ± 8.7	62.6 ± 9.4	5.8 (2.0, 8.2)	
Cervical Right Lateral Flexion (deg)				
Clinical Manipulative	37.9 ± 5.3	41.4 ± 9.7	3.5 (1.1, 6.0)	2.7 (1.1, 5.9)
Cervical Manipulative	39.1 ± 8.6	45.3 ± 7.8	6.2 (3.8, 8.5)	
Cervical Left Lateral Flexion (deg)				
Clinical Manipulative	38.5 ± 5.4	40.2 ± 8.3	1.7 (0.5, 2.9)	0.6 (-2.3, 3.7)
Cervical Manipulative	39.7 ± 7.6	42.0 ± 6.9	2.3 (0.2, 4.5)	
Cervical Right Rotation (deg)				
Clinical Manipulative	68.0 ± 10.8	75.4 ± 12.3	7.4 (2.9, 9.7)	0.5 (-4.4, 5.3)
Cervical Manipulative	70.6 ± 12.4	77.5 ± 10.0	6.9 (3.7, 10.2)	
Cervical Left Rotation (deg)				
Clinical Manipulative	71.2 ± 11.6	76.3 ± 11.9	5.1 (2.1, 7.8)	2.5 (-1.8, 6.7)
Cervical Manipulative	71.4 ± 13.7	79.0 ± 9.7	7.6 (4.1, 11.1)	

Values are expressed as mean ± standard deviation for Baseline and immediate post-treatment means and as mean (95% confidence interval) for within- and between-group change scores / * Significant Group * Time interaction (ANOVA, $P < 0.05$)

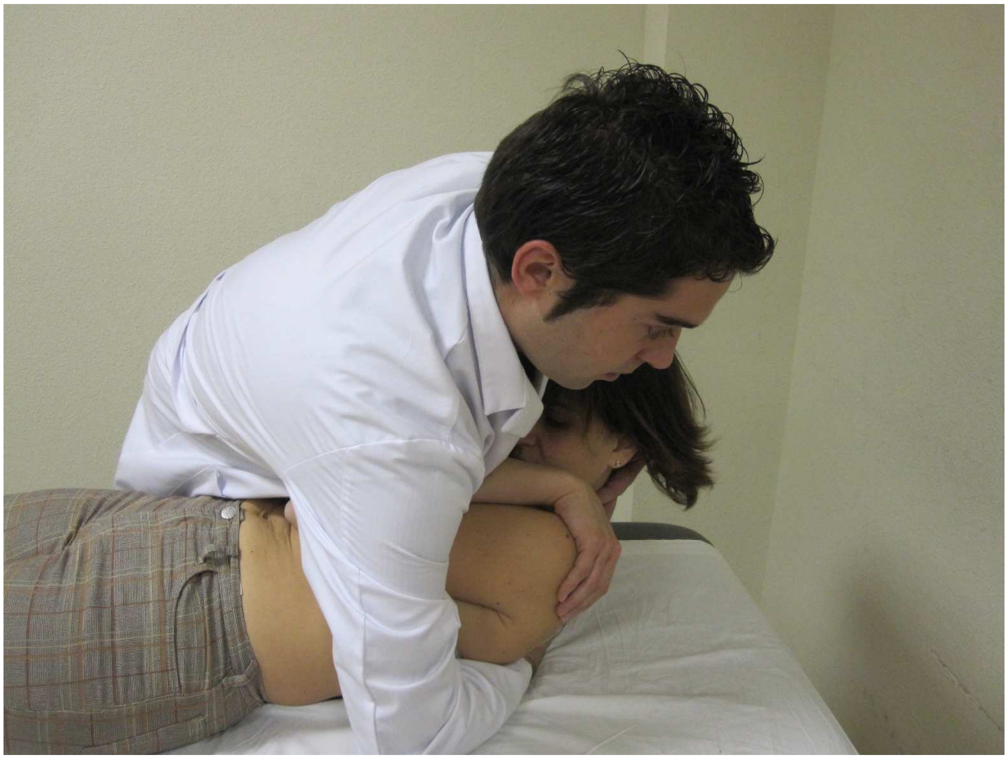

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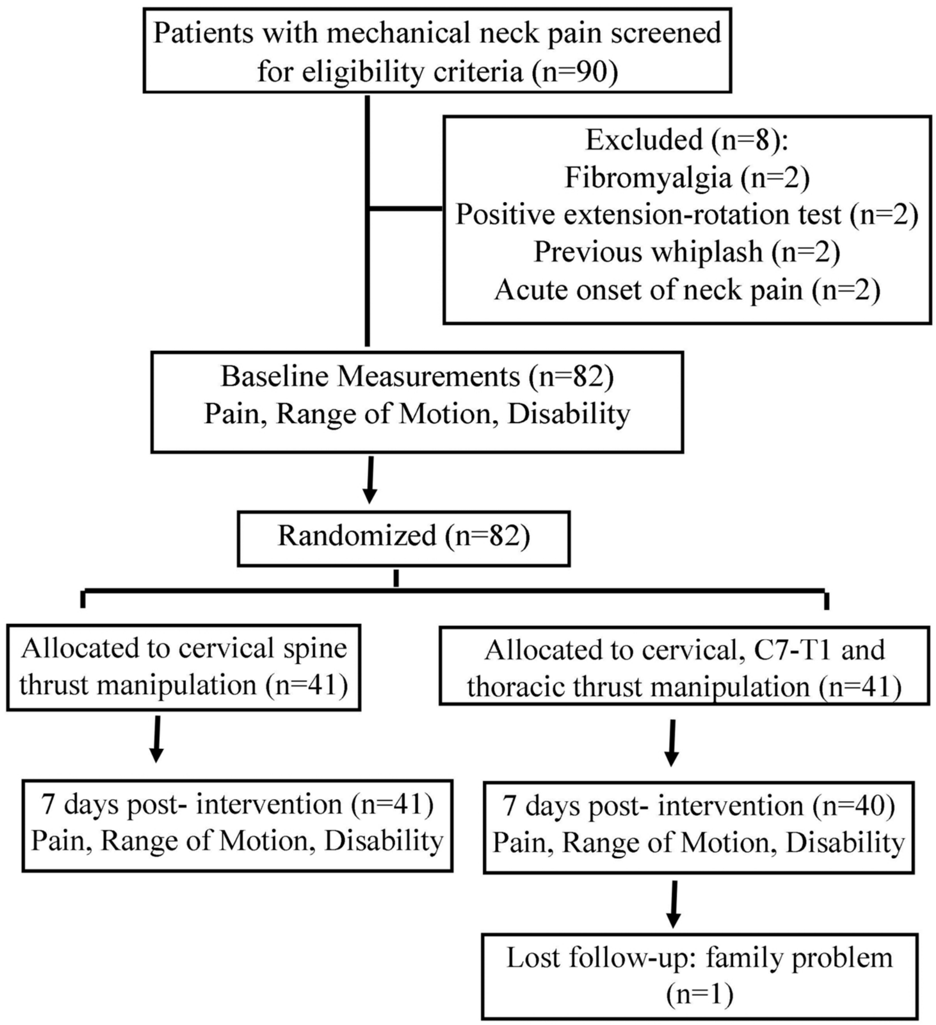
Figure 4: Flow diagram of patients throughout the course of the study



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IV. Pain Intensity, Physical Impairment and Pain-Related Fear to Function in Patients with chronic Mechanical Cervical Pain.

Autores: Saavedra-Hernández, Castro-Sánchez AM, Cuesta-Vargas AI, Cleland J, Fernández-de-las-Peñas C, Arroyo-Morales M. Amercian Journal Physical Medicne & Rehabilitation. En Revisión.

The Contribution of Previous Episodes of Pain, Pain Intensity, Physical Impairment and Pan-Related Fear to Disability in Patients with Chronic Mechanical Neck Pain

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Disclosures: Financial disclosure statements have been obtained, and no conflicts of interest have been reported by the authors or by any individuals in control of the content of this article.

No conflicts of interest

The Contribution of Previous Episodes of Pain, Pain Intensity, Physical Impairment and Pan-Related Fear to Disability in Patients with Chronic Mechanical Neck Pain

ABSTRACT

Objective: The influence of physical and psychosocial variables on self-rated disability in patients with chronic mechanical neck pain has not been fully determined. This study examined the relationship between pain, physical impairment, and pain-related fear to disability in individuals with chronic mechanical neck pain.

Design: A cross-sectional was conducted. One hundred-twenty (n=120) subjects (35 male, 85 female; age: 39 years) with chronic mechanical neck pain were prospectively recruited. Demographic information, duration of symptoms, pain intensity, pain-related fear and cervical range of motion (ROM) were collected. Self-reported disability was measured with the Neck Disability Index (NDI). Correlation and regression analysis were performed to determine the association between the variables and to determine the proportions of explained variance in disability.

Results: Significant positive correlations between disability and prior history of neck pain (r=0.59; P<0.001), disability and pain intensity (r=0.22, P=0.01), and disability and kinesiophobia (r=0.21, P=0.02) were found. Further, a significant negative correlation between disability and cervical extension ROM (r =-0.19, P=0.04) was also observed. Stepwise regression analyses revealed that previous neck pain episodes, the intensity of neck pain, kinesiophobia and cervical extension ROM were significant predictors of disability (r^2=0.452; r^2 adjusted=0.433; F=22.91; P<0.001).

Conclusions: This study found that previous episodes of neck symptoms, pain intensity, pain-related fear and cervical extension ROM explained 45% of the variability of self-report disability. Longitudinal studies will help to determine the clinical implications of these findings.

Keywords: neck pain; disability; range of motion; kinesiophobia.

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INTRODUCTION

Neck pain is a common problem which most people experience at some point in their life. Most cases appear to run a chronic-episodic course.[1] Neck pain and its related disability have a huge impact on individuals, their families, communities, health-care systems, and economy.[2,3] The point prevalence of neck pain in the general population in high-income countries has been reported to be 27.2% in females and 17.4% in males, while in low- and middle-income countries the mean has been shown to be 17.5%.[1] Neck pain results in severe disability in 5 % of affected people.[4] A better understanding of physical and psychological impairments associated with neck-related disability can potentially assist clinicians in determining adequate therapeutic programs in this group of patients.

Previous research has shown that different demographic and socioeconomic factors such as gender or age have prognostic value in patients with neck pain.[4] It is also plausible that clinical characteristics of neck pain, e.g., intensity, duration of symptoms, or number of previous episodes have also an influence in the prognosis for patients with neck pain.[5-7] The potential influence of these factors warrants further investigation.

The fear avoidance model explains that avoidance of pain and painful activities because of fear leads to physical and psychological consequences in patients with pain.[8] Research has demonstrated that the fear avoidance model can be applied to patients with neck pain.[9,10] Chronic pain could produce a hipervigilance which perpetuates a vicious cycle.[11] Howell et al.[12] have recently examined the fear avoidance model in a cohort of individuals with neck pain. In that study, self-rated disability in patients with chronic neck pain was found to be correlated with fear-avoidance beliefs and with impairment measures-ranges of motion in the cervical spine. However, the small sample size (n=35) does not allow for determining a definitive model relative to the potential implications of these variables in neck-related disability.

It has been reported that neck pain has also been associated with an alteration in spinal movements including reduced rotation, extension and retraction as compared to healthy people.[13] Decrease in cervical rotation has been confirmed in a group of female office workers with neck pain.[14] Other studies had added different outcomes and aspects of cervical mobility[15] or increased coupling motion.[16] A negative correlation between a reduction in cervical range of motion and disability has been proposed.[13] However, the contribution of decreased cervical range of motion in neck-related disability has not been previously studied.

Pain-related fear and reduced cervical range of motion are potentially modifiable risk factors for the development of chronic disability in patients with neck pain. For this reason, the purpose of the current study was to examine the relationship of pain-related fear, pain intensity and cervical range of motion to disability-related chronic mechanical neck pain in an outpatient orthopedic rehabilitation population.

METHODS

Participants

A cross-sectional design was used in the current study. One hundred and twenty-two patients from the Cervical Pain Clinic Study at University of Almeria participated. Eligible participants had to present with a report of neck and shoulder pain provoked by neck postures, neck movement, or palpation of the neck musculature. Exclusion criteria were as follows: 1, history of cervical surgery or whiplash injury; 2, medical diagnosis of cervical radiculopathy or myelopathy; 3, diagnosis of fibromyalgia; 4, evidence of central nervous system involvement and signs consistent with nerve root compression. All subjects read and signed a consent form, and this study was approved by the ethics board of the Universidad de Almería.

Data collection

Eligible participants were first contacted by telephone, and those who agreed to participate were scheduled for initial testing appointment. Upon arrival they received a complete explanation of the study protocol and signed the consent form. Demographic and clinical characteristics were self-reported. If clinical and self-reported data were not consistent, we gave precedence to the clinical data.

Measurements

The NPRS (range, 0: no pain; 10: maximum pain) was used to assess the mean spontaneous neck pain intensity. The NPRS has been shown to be a reliable and valid method for pain assessment.[17]

The NDI consist of 10 questions measured on a 6-point scale (0: no disability; 5: full disability).[18] The numeric score for each item is summed for a total score varying from 0 to 50, where higher scores reflect greater disability. The NDI has demonstrated to be a reliable and valid self-assessment of disability in individuals with neck pain.[19]

Finally, we used the 11-item TSK that assesses fear of movement or of injury or reinjury.[20] Individuals rate each item on a 4-point Likert scale, with scoring alternatives ranging from "strongly disagree" to "strongly agree." Test-retest reliability for the TSK has been shown to be high.[20]

The clinical history included questions regarding the onset, nature and location of the symptoms, aggravating and relieving factors, and previous history of neck pain. A physical therapist with more than fifteen year of experience in the management of patients with neck pain assessed the cervical range of motion with a cervical range of motion goniometer (CROM) which has shown to exhibit intra-tester reliability between 0.87 and 0.96 in individuals with neck pain.[21]

Statistical Analysis

Means and standard deviations were calculated to describe the sample. Pearson product Correlation coefficients were calculated to determine relationships between the dependent measure (disability) and the following independent variables: age, gender, previous episodes, days from symptoms onset, perceived pain, kinesiophobia, cervical range of motion (ROM) and body mass index. Similar analyses were used to examine relationships between independent variables to check for multicollinearity and shared variance between the measures.

A regression model was used to determine the independent variables that contributed significantly to variance in self-rated disability. A hierarchical regression analysis examined the proportions of explained variance in NDI score. To analyze the unique contribution of pain-related fear to function beyond demographics, intensity of pain, and impairment measures, independent variables were entered into the regression model in 4 steps. Presence of previous episodes variable was entered into the model at the first step, followed by pain intensity (step 2) and extension ROM (step 3). Finally, kinesiophobia (TSK-11 score) was added in the forth step. Changes in R^2 were reported after each step of the regression model to determine the influence of some additional variables. Last, variables that significantly contributed to neck disability were selected for inclusion in a parsimonious final regression model. The significance criterion of the critical F value for entry into the regression equation was set at $P < 0.05$. All analyses were performed using IBM SPSS Statistics 19.0.

RESULTS

Demographic data and mean impairment and outcome measure scores are listed in **Table 1**. Thirty five males and eighty -five females were included in the study. Mean age of the sample was 39 years (range, 19-59 years). Symptom onset was higher than or equal to 3 months for 97 individuals (80.8%). Seventy-three (63.3%) patients presented between 1 to 3 previous neck pain episodes and twenty-eight (23.3%) patients presented more than 10 previous episodes of neck pain.

Correlational Analyses

Significant positive correlations between disability and prior history of neck pain ($r=0.59$; $p<0.001$), disability and pain ($r=0.22$, $P=0.01$), disability and kinesiophobia ($r=0.21$, $P=0.02$) were identified: the higher number of previous neck pain episodes, the higher intensity of pain or the higher kinesiophobia, the greater the self-rated disability. Furthermore, a significant negative correlation between disability and extension cervical ROM ($r=-0.19$, $P=0.04$) was also found: the lower the cervical extension, the greater the disability.

In addition, significant correlations existed among the independent variables ($r = -0.19 < r < 0.59$; **Table 2**), but none were considered to be multicollinear (defined as $r > 0.80$); therefore, each one variable was included in regression analyses.

Regression Analyses

Stepwise regression analyses revealed that previous neck pain episodes, intensity of neck pain, kinesiophobia and cervical extension ROM were significant predictors of disability, and when combined, they explained 43.3% of the variance in self-perceived disability scores ($r^2=0.452$; r^2 adjusted=0.433; $F=22.91$; $P<0.001$) (**Table 3**).

DISCUSSION

The objective of the current study was to investigate the relationships between disability and clinical characteristics including cervical range of motion, pain intensity and kinesiophobia in patients suffering from chronic mechanical neck pain. Our sample of participants exhibited a moderate intensity of pain[22] and disability, [18] a low level of kinesiophobia[23] and reduced range of motion in flexion, extension and side bending of the cervical spine.[24] In our sample, 98.3% of patients with neck pain patients reported moderate disability following criteria previously reported by Vernon et al.[18] Similar levels of disability have been reported in a previous study.[25]

We found significant low to moderate positive associations between disability, presence of previous episodes of neck pain, the intensity of current neck pain, and also kinesiophobia and a negative association between disability and cervical extension. In fact, results from the regression analyses showed that presence of previous neck pain episodes; pain intensity, kinesiophobia and cervical extension ROM were significant predictors of neck-pain disability. We found that age, sex, and duration of symptoms do not influence neck-related disability which agree with studies conducted in patients with chronic whiplash associated disorders[26] and neck pain.[25]

Our findings also support an association between the presence of previous pain episodes and neck pain disability.[27-30] Furthermore, Bot et al. identified that patients who at baseline reported a previous episode of neck pain were significantly more likely to still be experiencing pain at a 3 month and 12 month follow-up period.[30] We also found that cervical range of motion may also influence neck disability similarly to the findings of others.[31,32] It is plausible that a history of repeated episodes of neck pain and reduced cervical range of motion could be indicative of a lack of recovery from previous bouts of neck pain as well as the persistent nature of mechanical neck pain. Methods to prevent patients with this clinical presentation from progressing to chronicity require further attention in the literature.

Our results further support that fear-avoidance attitudes play an important role in current self-ratings of neck-pain disability in patients with chronic mechanical neck pain which is similar to the findings in patients with whiplash.[26,32] This suggests that it may be essential for clinicians to understand the importance of these psychosocial issues when managing patients with both acute and chronic neck pain.[33] It is possible that if fear-avoidance attitudes are identified in the acute stage and managed accordingly, it could prevent the development of chronic symptoms. However, this hypothesis required further investigation.

The results of the current study indirectly suggest that the biopsychosocial model which recognizes that individuals exhibit a combination of somatic and psychological factors influenced by social context, may be beneficial in the management of patients with neck-related disability.[34,35] The identification of patients at risk for prolonged disability may allow for appropriate management strategies and potentially enhanced the outcomes. Clinicians need to develop multimodal therapeutic strategies combining therapeutic exercise directed at musculoskeletal impairments, e.g., reduced range of motion, and cognitive educational programs to reduce the influence of exaggerated pain perception to determine the effectiveness of preventing prolonged neck-pain disability.

There are a number of limitations that should be recognized. First, we used a cross-sectional design. In fact, because of the sample size, the number of independent variables included in the regression analysis was limited to reduce the like hood of type II error. Further, due to the cross-sectional study design, a cause and effect relationships between those variables associated with prolonged disability cannot be inferred. Second, since all patients were outpatient orthopedic rehabilitation population, extrapolation of the current results to the general population should be considered with caution. Finally, other potential variables, such as sleep disturbances, [36] were not included in this study.

In summary, the current study examined the influence of cervical range of motion, as well as the role of pain related-fear and different clinical variables on self-reported disability in individuals with chronic mechanical neck pain. Previous episodes of symptoms, pain intensity, pain related fear and cervical extension range of motion explained 45% of the variability of self-report disability. Future longitudinal studies will help to determine the clinical implications of these findings.

REFERENCES

1. Hoy DG, Protani M, De R, Buchbinder R. The epidemiology of neck pain. Best Pract Res Clin Rheumatol 2010; **24**(6): 783-792.
2. Guzman J, Hurwitz EL, Carroll LJ et al. A new 2000-2010 task force on neck pain and its associated disorders. Spine 2008; **33**(4) : S14-S23.
3. Haldeman S, Carroll L, Cassidy JD. Findings from the bone and joint decade 2000 to 2010 task force on neck pain and its associated disorders. J Occupational Environm Med 2010; **52**(4): 424-427.
4. Cote P, Cassidy D, Carroll L. The Saskatchewan health and back pain survey: the prevalence of neck pain and related disability in Saskatchewan adults. Spine 1998; **23**(15): 1689-98.
5. Hoving JL, de Vet HC, Twisk JWR et al. Prognostic factors for neck pain in general practice. Pain 2004; **110**(3): 639-645.
6. Kjellman G, Skargren E, Oberg B. Prognostic factors for perceived pain and function at one-year follow-up in primary care patients with neck pain. Disabil Rehabil 2002; **24**(7): 364-370.
7. Bot SD, van der Waal JM, Terwee CB et al. Predictors of outcome in neck and shoulder symptoms: a cohort study in general practice. Spine 2005; **30**(16): E459-70.
8. Lundberg MKE, Styf J, Carlsson SG. A psychometric evaluation of the Tampa Scale for Kinesiophobia - from a physiotherapeutic perspective. Physiother Theory Pract 2004; **20**(2): 121-133.
9. Karels CH, Bierma-Zeinstra SM, Burdorf A et al. Social and psychological factors influenced the course of arm, neck and shoulder complaints. J Clin Epidemiol 2007; **60**(8): 839-48.

10. Hudes K. The Tampa Scale of Kinesiophobia and neck pain, disability and range of motion: a narrative review of the literature. J Can Chiropr Assoc 2011; **55**(3): 222-232.

11. Lentz TA, Barabas JA, Day T et al. The relationship of pain intensity, physical impairment, and pain-related fear to function in patients with shoulder pathology. J Orthop Sports Phys Ther 2009; **39**(4): 270-277.

12. Howell ER, Hudes K, Vernon H et al. Relationship between cervical range of motion, self-rated disability and fear of movement beliefs in chronic neck pain patients. J Musculoskeletal Pain 2012; **20**(1): 18-24.

13. Lee H, Nicholson LL, Adams RD. Cervical range of motion associations with subclinical neck pain. Spine 2004; **29**(1): 33-40.

14. Johnston V, Jull G, Souvlis T et al. Neck move-ment and muscle activity characteristics in female office workers with neck pain. Spine 2008; **33**(5): 555-563.

15. Sjolander P, Michaelson P, Jaric S et al. Sensorimotor disturbances in chronic neck pain–range of motion, peak velocity, smoothness of movement, and repositioning acuity. Man Ther 2008; **13**(2): 122-131.

16. Guo LY, Lee SY, Lin CF et al. Three-dimensional characteristics of neck movements in subjects with mechanical neck disorder. J Back Musculoskelet Rehabil 2012; **25**(1):47-53.

17. Katz J, Melzack R. Measurement of pain. Surg Clin north Am 1999; **79**(2): 231-252

18. Vernon H, Mior S. The Neck Disability Index: A study of reliability and validity. J Manipulative Physiol Ther 1991; **14**(7): 409-415.

19. Macdemid JC, Walton DM, Avery S et al. Measurement properties of the neck disability index: A systematic review. J Orthop Sports Phys Ther 2009; **39**(5): 400-17.

20. Woby SR, Roach NK, Urmston M et al. Psychometric properties of the TSK-11: a shortened version of the Tampa Scale for Kinesiophobia. Pain 2005; **117** (2):137-144.
21. Fletcher JP, Bandy WD. Intrarater reliability of CROM measurement of cervical spine active range of motion in persons with and without neck pain. J Orthop Sports Phys Ther 2008; **38**(10): 640-5.
22. Williamson A, Hoggart, B. Pain: a review of three commonly used pain rating scales. J Clin Nurs 2005; **14**(7): 798-804.
23. Vlaeyen JWS, Kole-Snijders AMJ, Boren RGB et al. Fear of movement/(re) injury in chronic low back pain and its relation to behavioural performance. Pain 1995; **62**(3): 363-372.
24. Youdas JW, Garret TR, Suman VJ et al. Normal range of motion of the cervical spine: an initial goniometric study. Phys Ther 1992; **72**(11): 770-780.
25. Landers MR, Creger RV, Baker CV et al. The use of fear-avoidance beliefs and nonorganic signs in predicting prolonged disability in patients with neck pain. Man Ther 2008; **13(3)**: 239-248.
26. Vernon H, Guerriero R, Soave D et al. The relationship between self-rated disability, fear-avoidance beliefs, and nonorganic signs in patients with chronic whiplash-associated disorder. J Manipulative Physiol Ther 2011; **34**(8): 506-513
27. Makela M, Heliövaara M, Sievers K et al. Prevalence, determinants, and consequences of chronic neck pain in Finland. Am J Epidemiol 1991; **134**(11): 1356-1367.
28. Côté P, Cassidy JD, Carroll L. The factors associated with neck pain and its related disability in the Saskatchewan population. Spine 2000; **25**(9): 1109-1117.
29. Riddle DL, Stratford PW. Use of generic versus region-specific functional status measures on patients with cervical spine disorders. Phys Ther 1998; **78**(9): 951-963.

30. Bot SD, van der Waal JM, Terwee CB, van der Windt DA, Scholten RJ, Bouter LM, Dekker J. Predictors of outcome in neck and shoulder symptoms: a cohort study in general practice. Spine 2005; **30**(16): E459-70
31. Hermann KM, Reese C. Relationships among selected measures of impairment, functional limitation, and disability in patients with cervical spine disorders. Phys Ther 2001; **81**(3): 903-914
32. Vernon H, Guerriero R, Kavanaugh S et al. Psychological factors in the use of the Neck Disability Index in chronic whiplash patients. Spine 2010; **35**(1): E16–E21.
33. Murphy DR, Hurwitz EL. The usefulness of clinical measures of psychologic factors in patients with spinal pain. J Manipulative Physiol Ther 2011; **34**(9): 609-613.
34. Peters ML, Vlaeyen JWS, Weber WEJ. The joint contribution of physical pathology, pain-related fear and catastrophizing to chronic back pain disability. Pain 2005; **113**(2): 45–50.
35. Sterling M. Balancing the “bio” with psychosocial in whiplash associated disorders. Man Ther 2006; **11**(3):180-181

36. Valenza MC, Valenza G, González-Jiménez E, De-la-Llave-Rincón AI, Arroyo-Morales M, Fernández-de-Las-Peñas C. Alteration in Sleep Quality in Patients with Mechanical Insidious Neck Pain and Whiplash-Associated Neck Pain. Am J Phys Med Rehabil. 2011 Dec 14

Table 1: Demographics and Baseline Variable Scores

	Mean (95% CI)	**SD**
Age (years)	39.3 (37.7 - 40.9)	8.8
Body mass Index ($Kg*m^{-2}$)	24.5 (23.7 - 25.2)	4.0
Numerical Pain Rat Scale (NPRS, 0.10)	5.3 (5.0 - 5.6)	1.9
Tampa Scale of Kinesiophobia (TSK-11, 11-44)	24.3 (22.9 - 25.6)	7.3
Neck Disability Index (NDI, 0-50)	16.5 (15.4 - 17.5)	5.3
ROM Neck flexion (º)	54.1 (52.3- 55.9)	9.8
ROM Neck extension (º)	49.8 (47.2 - 52.4)	14.2
ROM Neck right side flexion (º)	38.1 (36.7 - 39.5)	7.6
ROM Neck left side flexion (º)	38.8 (37.7 - 39.9)	5.9
ROM Neck right rotation (º)	69.9 (67.8-72.1)	11.7
ROM Neck left rotation (º)	72.7 (70.5-74.9)	12.1

ROM: range of motion

Table 2: Pearson-Product Moment Correlation Matrix for Study Variable

Variable	NDI	NPRS	TSK	ROM Flexion	ROM Extension	ROM Side right	ROM Side left	ROM Rotation right	ROM Rotation Left	Gender	Age	BMI	Previous episodes	Cronicity
NDI	1.00	0.218*	0.209*	0.001	-0.182*	-0.045	-0.073	-0.118	0.017	0.019	0.114	0.021	0.588**	0.115
NPRS	0.218*	--	0.187*	0.177	0.014	0.075	0.115	0.026	0.040	0.091	0.030	-0.091	0.029	-0.145
TSK	0.209*	0.187*	--	-0.001	0.011	0.048	0.040	-0.021	-0.065	-0.101	0.094	-0.064	0.043	-0.113
ROM Flexion	0.001	0.117	-0.001	--	0.133	0.418**	0.290**	0.259**	0.309**	0.012	-0.033	-0.086	0.081	0.109
ROM Extension	-0.182*	0.014	0.011	0.133	--	0.409**	0.466**	0.209*	0.171	0.015	0.013	-0.080	0.051	0.007
ROM Side Right	-0.045	0.075	0.048	0.418*	0.409**	--	0.498**	0.367**	0.357**	-0.021	-0.136	-0.067	0.054	-0.011
ROM Side Left	-0.073	0.115	0.040	0.290*	0.466**	0.498**	--	0.271**	0.298**	-0.023	-0.115	0.006	-0.043	-0.073
ROM Rotation Right	-0.118	0.026	-0.021	0.259*	0.209*	0.367**	0.271**	--	0.621**	0.073	-0.209*	-0.073	0.022	0.080
ROM Rotation Left	0.017	0.040	-0.065	0.309*	0.171	0.357**	0.298**	0.621**	--	0.113	-0.055	-0.011	0.162	0.231*
Gender	0.019	0.091	-0.101	0.012	0.015	-0.021	-0.023	0.073	0.113	--	0.066	-0.155	-0.042	0.148
Age	0.114	0.030	0.094	-0.033	0.013	-0.136	-0.115	-0.209*	-0.055	0.066	--	0.370**	0.050	-0.040
BMI	-0.006	-0.145	-0.151	0.080	-0.156	-0.009	0.006	0.073	-0.011	-0.155	0.370**	--	0.065	0.015
Previous Episodes	0.588*	0.029	0.043	0.081	0.051	0.054	-0.043	0.022	0.162	-0.042	0.050	0.065	--	0.245**
Chronicity	0.115	-0.145	-0.113	0.109	0.007	-0.011	-0.011	0.080	0.231*	0.148	-0.040	0.015	0.245**	--

* P < 0.05; ** P < 0.01

Table 3: Summary of Stepwise Regression Analyses to Determine Predictors of Disability, r^2= 43.3 %

Independent Variable	**β**	**95% CI**	**t**	**P**
Intercept	10.18	5.86, 14.50	4.67	<0.001
Previous neck pain episodes*	2.39	1.83,2.96	8.28	<0.001
Perceived Pain	0.65	0.18, 1.13	2.75	0.007
Tampa Scale of Kinesiophobia	0.10	-0.01, 0.21	1.96	0.048
Extension Cervical Range of Motion	- 0.08	-0.13, -0.02	-2.90	0.004

* Previous neck pain episodes coded as: (0) not previous episodes, (1) 1-3 prior episodes, (2) 3-10 episodes, (4) more than 4 episodes.

CONCLUSIONES

I. La regla de predicción clínica para el dolor mecánico cervical susceptible de mejora mediante técnica de manipulación espinal aplicada en nivel medio cervical, charnela cérvico-dorsal y dorsales altas, ha identificado cinco variables potencialmente predictoras de éxito terapéutico, como son hipomovilidad en T1, test neurodinámico de miembro superior negativo, extensión cervical inferior a 46º, una valoración de 4,5 puntos en la escala NPRS, y pertenecer al sexo femenino.

II. Los pacientes con dolor mecánico cervical que recibieron manipulación espinal a nivel cervical-medio y en charnela cérvico-dorsal, exhibieron similares resultados en rango de movilidad cervical, reducción de la intensidad del dolor y discapacidad, respecto del grupo que recibió Kinesio Taping. Los cambios en el dolor cervical fueron superiores al rango establecido como diferencia clínica mínimamente importante. Sin embargo, los cambios obtenidos en la discapacidad fueron ligeramente inferiores a los establecidos como diferencias mínimas clínicamente importantes.

III. La aplicación de una manipulación espinal a nivel cervical medio fue igualmente efectiva en la reducción del dolor cervical y en el aumento del rango del movimiento, comparado con la aplicación combinada de técnicas de manipulación espinal dirigidas al segmento cervicotorácico. Sin embargo, la mejora de la discapacidad fue mayor en los pacientes que recibieron la técnica combinada de manipulación espinal en el segmento cervicotorácico.

IV. La discapacidad percibida en el paciente con dolor mecánico cervical está relacionada con haber padecido episodios previos de dolor, miedo al dolor, episodio actual de dolor intenso y dolor en el rango de movimiento de extensión cervical.

V. En definitiva podemos concluir que la terapia manipulativa espinal y el kinesio taping son procedimientos terapéuticos efectivos para el dolor mecánico cervical, debido a que se obtienen resultados similares en la reducción de la intensidad del dolor percibida por el paciente, y en los cambios producidos en el rango de movimiento; obteniendo como salvedad, una mejora en la discapacidad mediante la técnica combinada de manipulaciones espinales cérvico-dorsales.

AGRADECIMIENTOS

Nunca imaginé que me resultara tan difícil transformar en unas cuantas palabras este profundo sentimiento de agradecimiento a tantas personas que han garantizado que este sueño se cumpla.

Una vez que me enfrento a esta situación y echo un vistazo hacia atrás, me es imposible evitar una sonrisa que nace desde lo más profundo de mí. No paran de aparecer caras y momentos vividos, circunstancias que me han conducido a este preciso instante y que me hacen pronunciar constantemente: GRACIAS.

Ha sido un proyecto muy importante para mí, que ha visto la luz gracias al esfuerzo de gente también muy especial cuyo amor, entusiasmo, energía y pericia, han hecho posible que esto sea una realidad.

Vuestro apoyo, compromiso y sentido del éxito, me conmueve de veras. Vuestra leal confianza y voluntad de abrirme vuestra mente y vuestro corazón, me ha aportado la fuerza necesaria para no rendirme nunca.

Gracias por aportar tanta positividad a mi vida.

A mi director Manuel Arroyo, por ser una fuente de inspiración constante para mí. Por tu incansable y continuado esfuerzo que siempre me conducen hacia la grandeza. Por ser un ejemplo vivo de integridad y superación. Por ir siempre por delante allanando el camino. Por tu gratuidad y generosidad conmigo (nunca olvidaré la mañana de los sellos). Gracias por ayudarme a alcanzar mis retos y ser mi amigo.

A mi directora Adelaida Castro, gracias por tu valiosa e inagotable ayuda (han sido tantas horas, y… a qué horas), Por tu compromiso y dedicación, Por tu disciplina y orden. Por garantizar el conocimiento necesario para que esto sea lo que es. Gracias por tu entrega.

A mi director César Fernández, gracias por brindar tus conocimientos, por hacerlo todo más fácil, por el apoyo e impulso que le has dado a este trabajo. Gracias porque tus directrices han hecho esto posible.

A mi mujer, si hay alguien que ha hecho esta tesis, ha sido Eva. Cuanto apoyo emocional, cuanto apoyo…, siempre animándome a seguir, siempre alimentando mis sueños, aguantando el “me tengo que ir” , nadie más que tú sabe lo que esto cuesta, los desánimos, el no merece la pena, pero tu ahí, dale que dale. A cuántas cosas has renunciado y no se notaba, siempre mirándome a mí. Siempre juntos, mi vida.

A mis tres hijas, Eva, Beatriz y Miriam, que son las estrellas que iluminan mi alma. Sois mis verdaderas maestras y la gran motivación que me ayuda cada día a ser un poquito mejor, a superar el miedo y a romper mis propios límites.

A mis padres, que me lo han dado todo, las raíces para ser quien soy, el coraje para mirar siempre de frente a la vida, el alma limpia de quien hace las cosas honestamente, el espíritu de incansable sacrificio, el amor que me hace creer en la misericordia de Dios, la sencillez y la humildad de quien lo da todo sin esperar nada a cambio. A ti mamá, a ti papá, gracias por estar siempre a mi lado, gracias por darme la vida. Me siento orgulloso de ser vuestro hijo.

A mi hermano Ventura, mi compañero de tantas batallas. Gracias por estar siempre ahí conmigo, incansable, apoyándome incondicionalmente, sin preguntas, nunca pusiste una pega a mis ausencias. Gracias por ser mi hermano.

A mi hermano Paco, porque a pesar de nuestras distancias y silencios, sé que tu amor y admiración son de verdad. Gracias por tu generosidad conmigo; sé que cuando te necesito, acudes sin vacilar. Gracias por ese corazón tan grande que escondes ahí dentro. Siempre serás mi hermano mayor.

A Antonio Montes, tu fuerza de voluntad y tu tesón han sido un ejemplo para mí. Gracias por sentirte tan orgulloso de mí (aunque nunca lo dices).

A mi prima Ana, porque con tu alegría y tu amor me hacías sentirme fuerte, me llevaba a mirar siempre hacia delante. Gracias por quererme.

A toda mi familia, cuñados y sobrinos, por tantos buenos momentos, por tantas experiencias vividas, por ayudarme en la vida, por compartir conmigo todo tipo de vivencias.

A todos mis amigos, por la inmensa suerte de encontraros en mi camino. Qué afortunado me hacéis sentir. Gracias por vuestro ánimo y entusiasmo y tantos momentos vividos, que siempre me inspiran a caminar erguido cada día.

A los que no están y que han formado una parte de mi historia. Ejemplos de vida. Gracias por vuestra Luz espiritual que guía mis pasos y hace que pueda cumplir este y tantos sueños.

A Nuria, agradecer tu ayuda en esos largos días de toma de datos y echar esas carcajadas que hacían más fácil las sesiones clínicas. Gracias.

A todos mis compañeros de trabajo, siempre habéis pensado que estaba un poco loco, no tenéis razón, estoy bastante loco. Gracias por tantas experiencias vitales vividas con vosotros, por el apoyo clínico con los pacientes, por vuestra amistad a pesar de ser a veces vuestro jefe.

A los pacientes, en realidad sois el verdadero sentido de toda mi vida profesional, sois el mejor agradecimiento que se me puede dar, hacéis que ame mi profesión, hacéis que no entienda otra forma de vida, que me emocione con lo que pasa en los tratamientos, que me sorprenda con los resultados, alucino con el ser humano, me enseñáis todos los días, sois el alma del sanador. Gracias por vuestra confianza.

Gracias a mis maestros, desde la infancia hasta hoy, tengo recuerdos muy especiales, que me hacen también amar la enseñanza, porque aprendes más que enseñas, ojalá un día alguien se acuerde de mí como yo me acuerdo de vosotros.

A los compañeros de la Universidad de Almería y a su personal de administración por su ánimo, cooperación y ayuda.

Gracias a todos por creer en mí.