UNIVERSIDADE FEDERAL DOS VALES DO JEQUITINHONHA E MUCURI
Programa de Pós-Graduação em Reabilitação e Desempenho Funcional

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EFEITOS AGUDOS DA MOBILIZAÇÃO FASCIAL TORACOLOMBAR NA DOR E NA FUNCIONALIDADE DE INDIVÍDUOS COM LOMBALGIA CRÔNICA: ensaio clínico controlado cruzado

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2020

Luana Rocha Paulo

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Orientador: Prof. Dr. Fábio Luiz Mendonça Martins
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Dissertação apresentada ao MESTRADO EM REABILITAÇÃO E DESEMPENHO FUNCIONAL, nível de MESTRADO como parte dos requisitos para obtenção do título de MESTRA EM REABILITAÇÃO E DESEMPENHO FUNCIONAL

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À minha família, marido e amigos pela compreensão.

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EFEITOS AGUDOS DA MOBILIZAÇÃO FASCIAL TORACOLOMBAR NA DOR E NA FUNCIONALIDADE DE INDIVÍDUOS COM LOMBALGIA CRÔNICA: ENSAIO CLÍNICO CONTROLADO CRUZADO

RESUMO

INTRODUÇÃO: A multicausalidade e variedade de desfechos presentes em indivíduos com dor lombar crônica (DLC), além da interação não linear decorrente da complexidade da interação de fatores causais, dificulta sua resolução. Embora a terapia manual (TM) para alívio da dor seja usada como adjuvante combinado ao exercício físico e/ou estabilização do *core* em indivíduos com DLC, ainda existe a crença de que uma única sessão de liberação miofascial seria eficaz. A TM é o meio de tratamento fisioterapêutico mais utilizado e estudos evidenciam sua ação na atenuação da inflamação em tecidos conectivos e prevenção de fibroses, auxílio na regeneração tecidual, redução da dor e aumento da mobilidade. Estudos observaram alterações na fáscia toracolombar que podem ser fatores predisponentes de dor lombar. Ainda não há consenso na literatura e há escassez de estudos quanto às técnicas específicas para a mobilização tecidual e os resultados na alteração da dor e funcionalidade.

OBJETIVOS: Avaliar se uma única sessão da técnica específica de liberação miofascial toracolombar reduz a dor e a incapacidade de indivíduos com DLC.

MÉTODOS: Quarenta e um indivíduos foram randomizados em três situações - experimental (Exp), placebo (Plac), controle (C) -, de maneira equilibrada e cruzada. Os indivíduos foram avaliados em termos de dor [Limiar da Dor por Pressão (PPT), Escala Visual Numérica de Dor (EVND)] e incapacidade (Índice de Incapacidade Oswestry ODI). Todas as análises foram realizadas antes e após os procedimentos, sendo que apenas o momento intervenção realizou a mobilização da fáscia toracolombar.

RESULTADOS: Testes de comparação múltipla revelaram que não havia efeitos entre, dentro dos testes e interação. De fato, nossos resultados mostraram IC 95% na situação Exp para PPT pré 24,70 a 36,06 N / m2 e pós 28,01 a 41,32 N / m2, EVND pré 2,30 a 3,69 e pós 2,38 a 3,89 e ODI pré 16,29% a 22,23 % e pós 16,22% a 22,36%.

CONCLUSÃO: Uma única sessão de mobilização manual da fáscia toracolombar não foi efetiva para reduzir a dor em sujeitos com DLC. Mais estudos precisam ser realizados em relação às técnicas e as respostas teciduais.

PALAVRAS CHAVE: fascia; dor lombar; mobilização miofascial.

ACUTE EFFECTS OF TORACOLOMBAR FASCIAL MOBILIZATION ON PAIN AND FUNCTIONALITY IN INDIVIDUALS WITH CHRONIC LOMBALGY: CROSS-CONTROLLED CLINICAL TRIAL

ABSTRACT

BACKGROUND: The multi-causality and variety of outcomes presented in individuals with chronic low back pain (CLBP), in addition to the non-linear interaction arising from the complexity of the interaction of causal factors, makes it difficult to resolve. Although manual therapy (MT) for pain relief is used as an adjunct combined with physical exercise and / or core stabilization in individuals with CLBP, there is still the belief that a single trial of myofascial release would be effective. Manual therapy is the most widely used physiotherapeutic treatment method and studies have shown its action in attenuating inflammation in connective tissues and preventing fibrosis, helping tissue regeneration, reducing pain and increasing mobility. Studies have observed changes in the thoracolumbar fascia that may be predisposing factors for low back pain. There is still no consensus in the literature and there is a lack of studies on specific techniques for tissue mobilization and the results in altering pain and functionality

OBJECTIVE: The aim of the study was to evaluate whether a single trial of specific thoracolumbar myofascial release technique reduces pain and disability of subjects with CLBP.

METHODS: Forty-one subjects were randomly enrolled in three situations - experimental (Exp), placebo (Plac), control (C) -, in a balanced and cross-over manner. Subjects were evaluated in terms of pain [Pressure Pain Threshold (PPT), Visual Numeric Pain Scale (VNPS)], and disability (Oswestry Disability Index ODI) both pre- and post-situations.

RESULTS: Multiple comparison tests revealed there were no effects between-, within-tests, and interaction. Indeed, our results showed for 95% CI in Exp situation to PPT pre 24.70 to 36.06 N/m^2 and post 28.01 to 41.32 N/m^2, to VNPS pre 2.30 to 3.69 and post 2.38 to 3.89, and to ODI pre 16.29% to 22.23% and post 16.22% to 22.36%.

CONCLUSION: A single trial of thoracolumbar myofascial release technique was not enough to reduce pain and disability in subjects with CLBP

KEY WORDS: fascia; low back pain; myofascial release.

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LISTA DE ABREVIATURAS

OMS – Organização Mundial de Saúde

DLC – Dor Lombar Crônica

TM – Terapia Manual

FTL – Fascia Toracolombar

MEC – Matriz Extra Celular

SNP – Sistema Nervoso Periférico

SNC – Sistema Nervoso Central

S1 – Córtex sensitivo primário

EVND – Escala Visual Numérica de Dor

SBST – Brasil – STarT Back Screening Tool Brasil

ODI – Oswestry Disability Index

PPT – Limiar da Dor por Pressão

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CAPÍTULO I – REFERENCIAL TEÓRICO

1 DOR LOMBAR CRÔNICA

A dor lombar é causa de inatividade e de altos custos na saúde em todo o mundo, atingindo 33% da população de acordo com a Organização Mundial de Saúde (OMS) (YANG *et al*., 2018). A maioria das pessoas tem um episódio de dor lombar aguda pelo menos uma vez no decorrer da vida e, embora muitos se recuperem dentro de um ano, alguns desenvolverão uma condição crônica com dor variante ou persistente de baixa ou média intensidade, interrompida por períodos sem dor ou de exacerbação da dor (VLAEYEN *et al*., 2018), e estima-se que em países considerados desenvolvidos, cerca de 2-5% da população tenha dor lombar crônica (DLC). Fritz, *et al.* (2011) observou que 25% dos pacientes que recebem tratamento fisioterapêutico é por queixas de DLC, entretanto apresentam desfechos variados com o tratamento que pode, muitas vezes, não resultar em melhora dos sintomas de dor ou disfunção. Essa condição pode estar associada à incapacidade funcional e para o trabalho, afetando, portanto, a qualidade de vida, como visto em uma análise da *Global Burden of Disease Study* publicada em 2015 (VOS *et al.*, 2015), que identificaram que a DLC foi uma das 10 principais causas de anos vividos com incapacidade em todos os 188 países avaliados entre 1990 e 2013.

Em um consenso publicado em 2017, diz que a dor crônica tem persistência além de 3 meses e, a partir de então, não é mais considerada um sintoma, mas um distúrbio em si que é mantido por fatores que podem ser diferentes dos iniciais, pois ultrapassa o tempo médio esperado de "cura" (DOLEYS, 2017). Em um estudo de 2018, Vlaeyen e colaboradores definem DLC como "dor, tensão muscular ou rigidez localizada abaixo da margem costal e acima das dobras glúteas" com a presença ou não de dor irradiada da lombar para membros inferiores, ou seja, dor radicular (VLAEYEN *et al*., 2018; BOGDUK, 2009). Foi reportado em outros estudos que a DLC não ocorre isoladamente, sendo que os sujeitos costumam apresentar queixas de dor em outras regiões do corpo e a grande maioria apresenta dor de características não específicas, o que pode ser consequência de fatores biopsicossociais (CHOLEWICKI *et al.*, 2019), de uma patologia primária ou fator nociceptivo não identificado (dor evocada por estimulação nociva de estruturas na coluna lombar) e experiências prévias de dor (VLAEYEN *et al.*, 2018; MERTENS *et al.*, 2015; WALLWORK *et al.*, 2016).

Durante uma experiência de dor, múltiplas áreas do cérebro são ativadas, caracterizando a chamada "neuromatriz da dor", formada pelo córtex cingulado anterior, o córtex sensitivo primário (S1), o tálamo, a ínsula anterior, o córtex pré-frontal e os córtices

parietais posteriores. Em uma tarefa dolorosa, essas áreas se comunicam umas com as outras, desenvolvendo um mapa da dor e causando desfechos diferentes. Algumas dessas áreas têm outras funções primárias, como execução de movimento, localização sensorial e consciência emocional (MERTENS *et al*., 2015; PUENTEDURA e FLYNN, 2016; WALLWORK *et al.*, 2016). Na dor crônica, essas áreas são sobrecarregadas, o que pode explicar consequências como alterações na concentração, desequilíbrios termorregulatórios, distúrbios do sono, problemas de memória de curto prazo, dentre outras alterações motoras e sensitivas (LOUW *et al.*, 2019; WOOD e HENDRICK, 2019).

Em relação à DLC não específica, é visto na literatura atual que possui componentes biológicos, psicológicos e sociais em várias extensões diferentes, além de a biomecânica ter seu papel no desenvolvimento dessa patologia (CHOLEWICKI *et al.*, 2019). Durante muito tempo o foco dos estudos para entender a dor lombar, em sua maioria, se deteve em patologias estruturais das vértebras e tecidos associados, fatores biomecânicos e neuropsicossociais e anormalidades no controle motor. Porém, alguns estudos têm proposto que as fáscias ou sistema miofascial pode ter envolvimento na DLC por apresentar redução do deslizamento e aumento em 25% da rigidez tecidual da FTL em indivíduos com dor (CHOLEWICKI *et al.*, 2019; TOZZI e VITTURINI, 2011; ZUGEL *et al*., 2018; De CONINCK *et al.*, 2018).

2 SISTEMA FASCIAL

De acordo com a nomenclatura oficial, fáscia é definida de acordo com aspectos histológicos e topográficos em escalas mesoscópica e microscópica, como “uma bainha, uma folha ou qualquer outra agregação dissecável de tecido conjuntivo que se forma sob a pele para anexar, envolver e separar músculos e outros órgãos internos” (ADSTRUM et al., 2016; STECCO & SCHLEIP, 2016; SCHLEIP *et al*., 2019). Já o sistema fascial é caracterizado por propriedades funcionais em escala macroscópica, como microvacúolos poliédricos de tecido conjuntivo dos quais conectam os sistemas corporais e, por hospedar células especializadas, permitem diversas funções, como a motora, a nervosa, a vascular e a visceral. Estes microvacúolos são capazes de mudar sua forma quando sofrem alguma tensão e também são capazes de gerir as variações de movimento, diferentes regulações das funções corporais e ainda garantem a eficiência dos sistemas. Essa composição dá ao tecido um alto nível de adaptabilidade em resposta a mudanças de condições internas e externas adaptando sua

arquitetura em resposta à carga local (SCHLEIP *et al*., 2019; MENSE, 2019; BORDONI *et al*., 2017; HODGES *et al*., 2019; ZUGEL *et al*., 2018).

Em nível celular, a homeostase deste tecido é resultado de uma complexa interação e conexão dinâmica entre componentes celulares e matriz extracelular (MEC). Pequenas alterações funcionais e estruturais na MEC resultam em um processo de adaptações celulares complexas e vice e versa (ZUGEL *et al.,* 2018). Estudos *in vitro* verificaram que há respostas dos fibroblastos de formas diferentes após algum estímulo ou estresse mecânico, como mudança na sua forma, síntese de substâncias biológicas fundamentais para o funcionamento celular, bem como substâncias proinflamatórias. Ademais, o estresse mecânico pode induzir a liberação e ativação de moléculas presentes na MEC, induzindo a clivagem do colágeno XVIII e de outros componentes da membrana, além de estimular a remodelação tecidual por síntese de colágeno (ZUGEL *et al*., 2018) e causar renovação e hidratação do tecido fascial, uma vez que, durante a aplicação, uma quantidade de água é empurrada para fora da zona de maior estresse e, logo após a retirada do mesmo, o tecido volta a receber água de tecidos circundantes e arteríolas. Essa dinâmica pode auxiliar não só na hidratação, mas a atenuar a inflamação pela renovação da água e melhorar a capacidade de armazenamento elástico (SCHLEIP *et al.,* 2012).

Como o tecido conectivo sofre remodelação constante em resposta ao estresse repetitivo criado pela pré-existência de fatores secundários ao esforço, e as funções de estruturas corporais são determinadas pela composição e pelas diferentes organizações do sistema fascial, posturas habituais, esporte praticado ou quaisquer alterações neste tecido podem influenciar o padrão de movimento. Além disso, o sistema fascial pode ser entendido como unidades inseparáveis de tecido conectivo, ou um *continuum* fascial, não permitindo a identificação de diferentes camadas, mas de diferentes densidades do tecido que podem ser compreendidas como camadas ou lâminas que compõem cadeias miofasciais de transmissão intermuscular de força ou tensão (VLEEMIMG *et al.*, 1995; KRAUSE *et al.*, 2016; BORDONI *et al*., 2017; ZUGEL *et al*., 2018).

2.1 Fáscia Toracolombar (FTL)

A fáscia toracolombar é de interesse especial, pois possui múltiplas conexões. Em sua anatomia, Vleeming e colaboradores (1995) viram através da dissecação de 10 cadáveres, que a FTL cobre os músculos das costas da região sacral, atravessando a região torácica até a nuca. Nos níveis de L4-L5 e sacro, existem conexões fortes entre as camadas superficial e

interna da FTL. Lateralmente, ela faz ligação dos eretores da espinha com os músculos obliquo interno e reto abdominal. A camada mais externa posterior faz ligação entre o grande dorsal, glúteo máximo e parte do oblíquo externo e trapézio. Essa camada tem suas fibras orientadas no sentido craniolateral e caudomedial, cruzando para o lado contralateral. A camada mais interna também tem orientação de fibras de craniomedial para caudolateral, tendo conexão sacral com a camada externa e com o ligamento sacrotuberoso. Na pelve, ela conecta-se com a crista ilíaca e ligamento sacroiliaco e vai até os ligamentos interespinhais na lombar contralateral a nível de L5-S1, alcançando lateralmente o oblíquo interno. Essa camada ainda cobre o músculo eretor espinhal e alcança o serrátil póstero-inferior na região torácica (VLEEMING *et al*., 1995). Entretanto, a FTL não tem camadas totalmente dissecáveis, uma vez que o tecido subcutâneo pertencente à FTL pode ser compreendido em camada superficial, que consiste em uma fina lâmina de fibras de colágeno em paralelo orientada perpendicularmente com a medula espinhal, uma camada intermediária contendo "pacotes" de fibras de colágenos grossas que correm obliquamente à coluna, e uma camada interna que compreende de tecido conjuntivo frouxo com fibras elásticas, mas todas conectadas entre si (MENSE, 2019).

A partir disso, é compreendido que existem conexões entre músculos do tronco e membros inferiores através da FTL (LANGEVIN *et al*., 2009; LANGEVIN *et al*., 2011; WILKE, NIEDERER, *et al.*, 2016) e a existência de cadeias miofasciais de transferência intermuscular de força ou tensão foi confirmada, sendo que a cadeia superficial posterior (composta pela fascia plantar, gastrocnemio, isquiossurais e eretor da espinha) foi a que mais apresentou resultados positivos nas análises, mas confirmam também a existência da cadeia funcional posterior (grande dorsal, glúteo máximo contralateral, vasto lateral) e da cadeia funcional frontal (adutor longo, reto abdominal contralateral, peitoral maior). As cadeias superficial posterior e funcional posterior abrangem a FTL (KRAUSE, et al., 2016; WILKE, *et al.,* 2016).

Estudos realizados em humanos e cadáveres sobre a transmissão de força ou tensão mostram que um tecido rígido ou mais complacente do que o esperado, pode influenciar a magnitude da transmissão intermuscular, podendo ter um significante efeito na mecânica corporal afetando o sistema de movimento do corpo humano, além de gerar dor e disfunção (LANGEVIN *et al*., 2009; LANGEVIN *et al*., 2011; CARVALHAIS *et al*., 2013; BORDONI *et al*., 2017). Um estudo com humanos revelou que a posição de repouso e a rigidez passiva do quadril podem ser influenciadas pela flexibilidade e contração de um

músculo anatomicamente distante, sendo a FTL responsável pela transmissão de força extramuscular miofascial entre as estruturas. Achados eletromiográficos confirmam essas afirmações e também que a transmissão de força e deslocamento do tecido fascial é multidirecional, assim como suas fibras (CARVALHAIS *et al.*, 2013; BARKER *et al*., 2004; ZUGEL *et al.*, 2018).

2.2 Inervação da FTL

Estudos verificaram que a FTL possui neurônios intersticiais particularmente sensíveis a repetidas estimulações mecânicas ou bioquímicas, em termos de uma hipersensibilidade subsequente de longa duração. Isso porque as terminações nervosas livres presentes neste tecido são constituídos de neurônios mielinizados e amielinizados que muitas vezes são compreendidos como nociceptores, mas apenas 45% dessas terminações tem um limiar mecânico baixo e podem ser ativados por estímulos fracos como uma pressão local não nociva (SCHILDER *et al.*, 2014; MENSE, 2019). A maioria desses neurônios são polimodais, ou seja, são sensíveis a mais de um tipo de estímulo. Se não há estímulos proprioceptivos suficientes sendo transmitidos ao corno posterior da medula por esses receptores, eles tendem a reduzir ativamente seu limiar para a estimulação nociceptiva. Isso também pode ocorrer quando há alterações na MEC do tecido ao redor das respectivas terminações nervosas (MENSE, 2019).

Mense (2019) verificou que a camada mais superficial da FTL, bem como a interna, possui a maioria das terminações nervosas livres. Esses neurônios sensoriais (fibras C) presentes na FTL apresentam densidade maior nas camadas mais superficiais entre a derme e uma região chamada de zona de cisalhamento transicional, onde o movimento de deslizamento da pele em relação aos tecidos subjacentes pode ser facilmente estimulado. A estimulação desses neurônios desencadeia uma ativação do córtex insular, causando uma sensação de bem estar e pertencimento social (MCGLONE *et al*., 2014; MENSE, 2019). Essas terminações nervosas livres são sensíveis a alterações dinâmicas de forças como compressão, tensão ou torção, contudo, foi visto que há melhores respostas e efeitos a nível molecular em consequência à tensão e cisalhamento que estão envolvidos na mobilização tecidual (FINDLEY *et al*., 2012; PUENTEDURA e FLYNN, 2016).

3 MOBILIZAÇÃO MIOFASCIAL

A manipulação do tecido conectivo ou mobilização miofascial foi definida como uma técnica de terapia manual onde o terapeuta aplica contato manual com a pele do paciente, podendo causar um efeito reflexo no sistema nervoso autônomo, induzida pela manipulação de camadas fasciais dentro ou sob a pele, ou ainda como uma facilitação de potencial adaptação mecânica, neural e psicofisiológica (HOLEY e DIXON, 2014; TOZZI *et al*., 2011). Pesquisadores do *Fascia Research Group* sugerem que a rigidez e o aumento da densidade do tecido fascial são reduzidas a partir de mobilizações teciduais e que, além disso, o tecido fascial tem propriedades piezoelétricas, ou seja, transforma força mecânica em energia. Portanto, a partir de aplicação de calor, movimentos ativos ou passivos e mobilizações teciduais, ocorre o aumento da viscoelasticidade da fáscia tornando-a mais maleável (FINDLEY *et al.*, 2012; BORDONI *et al.*, 2017).

Há evidências de que a terapia manual (TM) por mobilização miofascial pode promover melhora da inflamação em tecidos conectivos e prevenir fibroses induzidas por excesso de uso, restaurar e/ou otimizar a mobilidade de deslizamento tecidual tanto em fases agudas quanto crônicas de dor, e ainda melhorar a postura e a qualidade de vida (ZUGEL *et al.*, 2018; TOZZI *et al.*, 2011). Estudos sugerem que o estímulo mecânico transitório de técnicas manuais pode criar uma cascata de efeitos biomecânicos locais e efeitos neurofisiológicos mediados pelo sistema nervoso periférico (SNP), medula espinhal e centros superiores (SNC) (HODGES *et al.*, 2019; PUENTEDURA e FLYNN, 2016). Há também hipóteses de que as terminações nervosas presentes no tecido fascial se adaptam rapidamente a carga e podem auxiliar nos efeitos da mobilização miofascial em relação aos sistemas de entrada *(inputs)* do SNC, uma vez que as técnicas podem ser vistas como uma abordagem "de baixo para cima" (*down-top*) por subentender que o terapeuta esteja fornecendo informações para o SNC a fim de alterar o sistema de saída do cérebro (*output*), ou seja, a intenção é reduzir a entrada de estímulos nociceptivos no sistema nervoso e, assim, modular a experiência da dor (PUENTEDURA e FLYNN, 2016). Contudo, acredita-se que as intervenções manuais dependem de fatores mediados além do sistema nervoso e que não apenas o estímulo mecânico, mas também as experiências prévias e as crenças do paciente quanto à intervenção influenciam os resultados (HODGES *et al.*, 2019; HODGES e DANNELS, 2019).

Sugere-se, portanto, a hipótese de que há uma importante contribuição para dor lombar não específica atribuída a FTL, e a intervenção terapêutica por mobilização miofascial

pode atenuar os sintomas de DLC e reduzir a incapacidade após uma única sessão, além disso, as ligações entre a FTL e tecidos adjacentes possibilita inferir que uma movimentação ativa de tronco, como a flexão anterior, irá aumentar o cisalhamento tecidual quando aplicada concomitantemente à tensão manual do terapeuta, podendo desencadear efeitos fisiológicos com consequências positivas quanto à reorganização estrutural e mecânica tecidual e atenuar os sintomas de dor. Isso trará benefícios em curto prazo e um suporte científico ao tratamento de sujeitos com DLC não específica.

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CAPÍTULO II – ARTIGO CIENTÍFICO:

Uma única sessão de mobilização da fáscia toracolombar não reduz a dor e a incapacidade de indivíduos com dor lombar crônica? Um ensaio clínico controlado cruzado.

Resumo: Contexto: A multi-causalidade e a variedade de desfechos apresentados em indivíduos com dor lombar crônica (DLC), além da interação não linear decorrente da complexidade da interação de fatores causais, dificulta sua resolução. Embora a terapia manual (MT) para alívio da dor seja usada como adjuvante combinado ao exercício físico e / ou estabilização do núcleo em indivíduos com DLC, ainda existe a crença de que um único estudo de liberação miofascial seria eficaz. O objetivo do estudo foi avaliar se um único estudo da técnica específica de liberação miofascial toracolombar reduz a dor e a incapacidade de indivíduos com DLC. Métodos: Quarenta e um indivíduos foram randomizados em três situações - experimental (Exp), placebo (Plac), controle (C) -, de maneira equilibrada e cruzada. Os indivíduos foram avaliados em termos de dor [Limiar da Dor por Pressão (PPT), Escala Numérica de Dor Visual (VNPS)] e incapacidade (Índice de Incapacidade Oswestry ODI), pré e pós-situações. Resultados: Testes de comparação múltipla revelaram que não havia efeitos entre, dentro dos testes e interação. De fato, nossos resultados mostraram IC 95% na situação Exp para PPT pré 24,70 a 36,06 N / m2 e pós 28,01 a 41,32 N / m2, VNPS pré 2,30 a 3,69 e pós 2,38 a 3,89 e ODI pré 16,29% a 22,23 % e pós 16,22% a 22,36%. Conclusão: Um único estudo da técnica de liberação miofascial toracolombar não foi suficiente para reduzir a dor e a incapacidade em indivíduos com DLC. **Testes clínicos**. Identificador gov: ReBEC - número 8197

Palavras-chave: fascia; dor crônica; mobilização miofascial

Can a single trial of a thoracolumbar myofascial release technique not reduce pain and disability of subjects with chronic low back pain? A randomized and balanced cross-over study

Abstract: Background: The multi-causality and variety of outcomes presented in individuals with chronic low back pain (CLBP), in addition to the non-linear interaction arising from the complexity of the interaction of causal factors, makes it difficult to resolve. Although manual therapy (MT) for pain relief is used as an adjunct combined with physical exercise and / or core stabilization in individuals with CLBP, there is still the belief that a single trial of myofascial release would be effective. The aim of the study was to evaluate whether a single trial of specific thoracolumbar myofascial release technique reduces pain and disability of subjects with CLBP. Methods: Forty-one subjects were randomly enrolled in three situations - experimental (Exp), placebo (Plac), control (C) -, in a balanced and cross-over manner. Subjects were evaluated in terms of pain [Pressure Pain Threshold (PPT), Visual Numeric Pain Scale (VNPS)], and disability (Oswestry Disability Index ODI) both pre- and post-situations. Results: Multiple comparison tests revealed there were no effects between-, within-tests, and interaction. Indeed, our results showed for 95% CI in Exp situation to PPT pre 24.70 to 36.06 N/m^2 and post 28.01 to 41.32 N/m^2, to VNPS pre 2.30 to 3.69 and post 2.38 to 3.89, and to ODI pre 16.29% to 22.23% and post 16.22% to 22.36%. Conclusion: A single trial of thoracolumbar myofascial release technique was not enough to reduce pain and disability in subjects with CLBP. **Clinical Trials. gov Identifier:** ReBEC – number 8197

Keywords: fascia; chronic pain; myofascial release.

1. Introduction

Chronic low back pain (CLBP) is an important undesirable health problem throughout the world. Non-specific low back pain is the most widespread form of CLBP [1]. Ineffective and prolonged treatment of CLBP is a major social problem that results in disability and a huge economic burden worldwide [2].

Manual therapy (MT) is one of the possible management options to the treatment of CLBP. Myofascial release is a form of MT which involves the application of a low-load, long duration stretches to the myofascial complex, with the intent to restore optimal length of the fascial tissue, decrease pain, and improve functionality [3–5].

Although previous reports point the effect of stability or global physical exercise in pain relief of subjects with CLBP [6–10], there is still the belief that an isolated session of MT such as myofascial release is effective in reducing CLBP and augmenting functionality level, in spite of studies that have shown its use only as an adjunct to specific back exercises as more effective [11,12]. Despite myofascial release therapy produces significant improvement in pain and disability, to the best of our knowledge only one study investigated the effects of an isolate myofascial release protocol on pain and disability in patients with CLBP [13]. In this investigation, one of the areas chosen for intervention was the thoracolumbar, more precisely the thoracolumbar fascia (TLF), and the myofascial protocol used produced a significant improvement in pain, although the authors could not know whether the improvement was clinically relevant, since minimal clinically important differences (MCID) in pain and disability were included in the 95% confidence interval [13].

The TLF is an extremely complex structure of special interest and clinically important in people with CLBP, as it is a structure consists of collagen fibers with multidirectional orientation that make up layers of dense connective tissue interposed by loose vascularized connective tissue that allows tissue slippage and mobility of the trunk [5,14,15]. Although there is still no consensus regarding its anatomical organization, Vleeming et al. (1995)[14] observed strong connections between the anterior and posterior layers of TLF at the level of L4-L5. The anterior layer of the TLF is on the anterior side of lumbar vertebrae' transverse process, and the posterior layer, subdivided into two layers, is located behind the transverse process. The deep part of the posterior layer involves the spinal erectors and, through the sacrotuberous ligament, presents continuity with the hamstring tendon. The superficial part is formed by the fascia of the gluteus maximus with the opposite latissimus dorsum, which becomes important for the timing of the pelvic and scapular girdles [14,16].

Despite observing this anatomical distribution, the TLF layers are not fully dissectible, that is, they are all connected to each other [5], favoring the force transmission in movements in the sagittal plane by the existence of the intermuscular force transmission chain that connects spine erectors, hamstring, gastrocnemius and plantar fascia [17–20]. Therefore, any change in the structure of the tissue that constitute TLF, such as increased tissue stiffness and density, directly interferes with the mechanics of force transmission and sensory inputs originating from TLF [15,19,21].

Histological studies of the TLF demonstrate a high concentration of nociceptive receptors in the posterior layer of TLF, which can generate several sensory and proprioceptive inputs to the central nervous system, linked to the reduction of shear strain between the layers. Therefore, these factors can contribute to the persistence of pain in individuals with CLBP [21]. Recent studies using ultrasound imaging suggest that the TLF of patients with CLBP have increased stiffness and lower shear capacity compared to patients without LBP [18,19]. Other studies that have identified a significant decrease in shear strain between the layers of the TFL during trunk flexion in individuals with CLBP, having an association with increased stiffness and thickening, in addition to decreased deformation of the TLF [4,15,22].

The connections between the TLF and the adjacent tissues allow inferring that an active movement of the trunk, such as anterior flexion, will increase the shear of the tissue when applied concomitantly with the myofascial release. The expected effects include reduced stiffness and densification of fascial tissue [22,23], due to physiological effects with positive structural and mechanical consequences of tissue reorganization and attenuation of pain symptoms. However, it is known that

CLBP is a gap that needs to be further explored due to the countless factors influencing its outcome, and that fascial mobilization is still the target of research regarding its real effectiveness. Therefore, the present study aims to verify the immediate effect of a new myofascial release protocol on TLF of individuals with nonspecific CLBP, concerning pain and disability, in comparison with control and sham situations.

2. Methods

2.1 Ethical Principles

This study was conducted in accordance with ethical principles for research involving humans (principles of the Declaration of Helsinki) and received approval from the Ethics and Research Committee of the *Universidade Federal dos Vales do Jequitinhonha e Mucuri* (No. 3.435.537). Clinical Trials Registry (ReBEC - nº 8197).

2.2 Study Design

This was a double-blind crossover clinical trial study. Thus, both subjects and therapist were blinded. All subjects underwent three situations in a randomized and balanced order. The sequence of situations was randomized using a website (www.random.org). Firstly, a familiarization with the experimental procedures was performed, followed by anamnesis (age, sex, and level of physical activity) and evaluation of the prognosis or risk profile using STarT Back Screening Tool (SBST) questionnaire, which consists of 9 items divided into physical and psychosocial subscales [24].

2.3 Subjects

Subjects were recruited between February and June 2019 in the cities of Diamantina and Divinópolis, Minas Gerais, Brazil. Inclusion requirements were: men and women over 18 years old, with low back pain for more than 3 months and who had at least 2-3 points of pain at baseline by the Visual Numerical Pain Scale (VNPS) [25] and have low or sedentary level of physical activity [26]. Exclusion criteria were historic of previous or scheduled surgeries in the torso or limbs, as well as those with suspicion of severe fractures or pathologies (tumor, inflammation or infection, rheumatological disorder, aortic aneurysm), radiculopathy or neuropathy (with or without spinal canal stenosis with proof of magnetic resonance imaging - MRI), structural deformity in the spinal column, spondyloarthropathy, syndrome of the equine tail; significant movement limitation, disabling pain and physical disability that would make it impossible to perform the study procedures; use of painkiller or anti-inflammatory 48 hours before the first test block or during the study; neurological or psychiatric disorder; presence or suspicion of pregnancy.

2.4 Procedures

2.4.1 Tests

Forty-one subjects were selected and enrolled in three situations (1) control (C), 2) experimental (Exp), and 3) placebo (Plac), and performed on consecutive days respecting a minimum interval of 24 hours (washout period) in order to minimize the potential for confusion and carryover effects on outcomes [12].

C. The subjects were instructed to remain in the supine position for five minutes on a stretcher to minimize the effects of tension forces on the tissue, without performing movements, in order to mimic the time spent in the act of performing the intervention.

Exp. The subjects underwent a single session and new approach to be tested to release the TLF, in the position of sedestation with feet supported and the thoracolumbar region properly undressed. A trained researcher positioned the hands without sliding over the skin or forcing the tissue, with the cranial hand close to the last rib and at the T12-L1 level on the right side of the individual's body and

the caudal hand on the ipsilateral side between the iliac crest and the sacrum, causing tension in the tissues, moving the hands away in a longitudinal direction. Then, the participant was instructed to perform five repetitions of active anterior trunk flexion (30°), while the researcher followed the movement with both hands simultaneously positioned, without losing the initial tissue tension and position. The same technique and the same number of repetitions of active anterior trunk flexion were repeated with the researcher's hands positioned on the left side. This technique was applied for five minutes [12,27,28].

Plac. The subjects were not submitted to the technique of manual thoracolumbar fascia release, but they slowly performed ten repetitions (five minutes) of anterior active trunk flexion in the same position as the experimental situation.

2.4.2 Outcomes

The measurements of the pain were the primary outcome. Pressure Pain Threshold (PPT) and VNPS were used as instruments. As a secondary outcome, Oswestry Disability Index questionnaire (ODI - version 2.0) was applied to evaluate the prognosis and functionality of the subjects. All analyses were performed to compare the results before and after each experimental situation.

For pain measurements, the VNPS were used to quantify the intensity of pain, ranging from 0 to 10, with 0 classified as no pain and 10 the worst pain imaginable. This instrument has proved to be a concurrent and valid predictor as a measure of pain intensity [29]. The pain threshold was assessed using the PPT test (Wagner Instruments, FDX series, USA), with a graduation capacity of 50x0.05 lbf, 800x0.5 ozf, 25x0.02 kgf and 250x0. 2 N, 1 cm^2 plunger connected to a mechanical force gauge that indicates the pressure applied at the marked location. The plunger of the device was positioned perpendicular to the paravertebral muscle close to the pain site informed by the participant, respecting the proximity of 2cm lateral between L3-L4. The pressure was applied progressively, with an average of 100$g.sec^{-1}$, until the volunteer signaled the onset of pain or discomfort. After signaling, the device was removed from contact with the individual's body and Newton's quantification was noted [30,31].

The ODI questionnaire was used to quantify the disability caused by low back pain in daily activities. Score is given from 0% (no dysfunction; independence) to 100% (lowest level of functionality; total dependence), divided into 5 levels where the first describes no limitation and the others describe limitation or inability to function. The total score is the percentage value calculated by the following equation: Total score = (Σ item score / 50) x 100. With all 10 questions answered, the total score was divided by 50 (10 x 5). It must be taken into consideration that the ODI is a questionnaire with a one-dimensional factorial structure, important psychometric properties, and internal consistency, and its ability to measure functional limitations was considered close to perfect, according to the actual severity level of the experienced dysfunction, by the evaluated subjects [32].

2.5 Statistical Analysis

Data was described as Mean (95% Confidence Interval). The normality and homogeneity of the variables were assessed by the Shapiro-Wilk test and the Levene test, respectively. The effects and interactions in the two moments (pre and post) and three situations (C, Plac, Exp) were evaluated by factorial variance analysis (ANOVA 2x3) allowing comparisons between-tests, within-tests, and interaction. Tukey test was used as a Post Hoc for multiple comparisons of means. The level of significance adopted for all tests was 5%. Estimates of effect size and power were calculated using the GPower® program version 3.1.

3. Results

3.1 Subjects

The sample size was estimated by the GPower® program (Franz Faul, Universitat Kiel, Germany), version 3.1.9.2. For this, we used analysis A priori, considering ANOVA for comparisons between groups, for the variable VNPS [33]. The effect size was calculated from the difference in the means with standard deviation within each group of 0.9. Thus, considering an effect size of 0.42, power of 0.80%, and alpha error 5%, the sample size was estimated at 41 volunteers. There was no withdrawal, so there was no need to analyze the data with the intention to treat.

A total of 52 subjects accepted to participate, from them, 10 individuals gave up or not attended the test site on the scheduled date and 1 individual did not meet the described inclusion criteria. Therefore, 41 subjects participated in all stages of the research (Figure A1). Of the total of 41 individuals, 61% were women and 56% declared themselves sedentary. In addition, the mean age was 36 years and the self-reported pain averaged 3.4 to 3.7 points. Among the subjects, 56% were classified in terms of poor prognosis in the SBST as low risk (Table 1).

3.2. Outcomes

Pain: There were no statistical difference between-, within-tests, and interaction. The difference for PPT was around 3% to control, 8% to placebo and an increase of 14% to experimental. Considering the difference for VNPS, it was observed a change around 0.005% to control, 0.09% to placebo, and 0.04% to experimental, how observed in Table 2. Thus, the changes found were less than the MCID for CLBP. However, fourteen participants (34.1%) improved at the end of the experimental situation, with six of them showing a reduction greater than two points, according to MCID [25,29,34]. Of the six individuals, two had medium risk and four high risk of poor prognosis at SBST.

Functionality: Although the factor analysis revealed a difference between tests, there was no statistical significance by the Tukey post hoc multiple comparison test. Thus, there was no significant difference between- and within-tests. In addition, there was no interaction effect, as we can see in Table 2. The difference was an increase around 3% to control, and lower than 1% to placebo and experimental. This result reveals the scores change was lower than the MCID to ODI [25].

Table 1. Characteristics of the participants

Characteristics	**Subjects (n=41)** **Mean (95% CI) or %**
Age (years)	36 (22 to 50)
Gender, women (%)	60.98%
Self-reported physical activity level, n (%)	
Sedentary	56.09%
Perform some activity	43.91%
Self-reported Pain (score)	
VNPS baseline (0-10)	3.68 (1.39-5.97)
PPT (N)	34 (16.57-51.43)
SBST – prognosis (%)	
Low risk	56.1%
Medium risk	24.4%
High risk	19.5%

CI: confidence interval; VNPS: visual numeric pain scale; PPT: pressure pain threshold (N: Newtons); SBST: STarT Back Screening Tool.

Table 2. Effect of myofascial mobilization release compared with control, experimental and placebo.

Outcomes	Control mean (95% CI)	Placebo mean (95% CI)	Experimental mean (95% CI)	Between-tests				Within-tests				Interaction			
				P	F	η^2	Poder	P	F	η^2	Poder	p	F	η^2	Poder
PPT (N) pre	37,25 (32,63-41,86)	29,37 (23,93-34,81)	30,38 (24,70-36,06)	0,40	0,90	0,47	0,99	0,56	0,34	0,25	0,90	0,06	2,80	0,73	1,00
PPT (N) post	36,11 (30,90-41,31)	31,82 (26,12-37,52)	34,66 (28,01-41,32)												
VNPS (score) pre	3,41 (2,69-4,12)	3,80 (3,06-4,53)	3,00 (2,30-3,69)	0,06	2,79	0,73	1,00	0,80	0,06	0,05	0,25	0,61	0,48	0,32	0,97
VNPS (score) post	3,43 (2,76-4,09)	3,48 (2,73-4,22)	3,14 (2,38-3,89)												
ODI (%) pre	15,82 (12,91-18,74)	17,51(14,42-20,59)	19,26 (16,29-22,23)	0,007	5,01	0,83	1,00	0,73	0,11	0,07	0,31	0,97	0,02	0,02	0,11
ODI (%) post	18,04 (15,00-21,09)	17,70 (14,65-20,76)	19,29 (16,22-22,36)												

CI: confidence interval; VNPS: visual numeric pain scale; PPT: pressure pain threshold (N: Newtons); ODI: Oswestry Disability Index. η^2: Eta partial. N = 41. Factorial ANOVA(2x3)

4. Discussion

As it was suggested, the main findings demystified the belief that an isolated trial of manual therapy, as well as the thoracolumbar myofascial release technique, reduces pain and improves functionality in subjects with CLBP. Comparing the data of the intervention situation, the magnitude of the subjects' pain measured by VNPS, was not statistically significant, even with the presence of six participants showing a reduction in the VNPS consistent with the MCID that, according to literature, it is a reduction of approximately two points or 30% in the VNPS [25,29,34] (Farrar et al. 2001, Childs et al., 2005; Lauridsen et al., 2006). These results probably have suffered interference related to the heterogeneity of the studied population regarding the poor prognosis by SBST, with 56% of the individuals classified as low-risk, 24.4% medium risk and 19.5% high-risk. It is important to note that four individuals of high-risk and two from the medium risk, obtained a significant improvement at VNPS in the intervention situation. According to Fritz and cols. (2011)[24], there is a relationship between the risk categories and the magnitude of the participants' improvement at the end of the analysis, in which individuals with a higher risk of poor prognosis, presented a greater report of pain attenuation.

Regarding PPT measure, no significant difference was observed. According to Fischer (1987)[35], asymptomatic individuals are expected to refer to pain or discomfort to PPT test when reaching 5.6 kg/cm² in men and 3.8 kg/cm² in women. In a research with individuals with CLBP, Pöntinen (1998)[31] found 4.0 kg/cm² for the pain. However, the average value found in the previous data of this study (34 N or 3.4 Kg/cm²) was lower than that reported in the literature. This low initial pain threshold in PPT means that the participants were more sensitive to pain, which would lead them to consider an increase in the threshold for the test after the intervention. However, there was no change in the initial values. For being more sensitive to pressure, most of the individuals in this study may have lowered their PPT after de experimental protocol since it involved pressure applied by the therapist. Thus, therapies involving passive external pressure applied to or around the painful area should be avoided in patients with low PPT. On the other side, considering myofascial force transmission along myofascial chains, maybe therapies such as myofascial release techniques should be applied along the myofascial connections but somehow away of the tender area. But this was not the aim of this study and should be part of future research.

There is enough biological evidence for justifying the present study. Studies have found that TLF has interstitial neurons that are particularly sensitive to repeated mechanical or biochemical stimulation, in terms of subsequent long-term hypersensitivity. This is because the free nerve endings present in this tissue are made up of myelinated and unmyelinated neurons that are often understood as nociceptors, but only 45% of these endings have a low mechanical threshold and can be activated by weak stimuli such as a non-harmful local pressure [3,5] (SCHILDER et al., 2014; MENSE, 2019). Most of these neurons are polymodal, that is, they are sensitive to more than one type of stimulus. If there are not enough proprioceptive stimuli being transmitted to the posterior horn of the medulla by these receptors, they tend to actively reduce their threshold for nociceptive stimulation. This can also occur when there are changes in the extra cellular matrix of the tissue around the respective nerve endings [5,36] (TESARZ, 2011; MENSE, 2019).

Mense (2019)[5] found that the most superficial layer of TLF, as well as the inner layer, has many free nerve endings. These sensory neurons (C fibers) present have a higher density in the most superficial layers between the dermis and a region called the transitional shear zone, where the sliding movement of the skin in relation to the underlying tissues can be easily stimulated. The stimulation of these neurons triggers an activation of the insular cortex, causing a sense of well-being and social belonging [5,37] (MCGLONE et al., 2014; MENSE, 2019). These free nerve endings are sensitive to dynamic changes in forces such as compression, tension or torsion, however, it has been seen that there are better responses and effects at the molecular level as a result of the tension and shear that are involved in tissue mobilization [23,38] (FINDLEY et al., 2012 ; PUENTEDURA and FLYNN, 2016). Despite of the laboratory evidence cited above, these possible mechanisms are not supported by the clinical findings of the present study.

Tozzi et al. (2011)[39] obtained pain attenuation after a single session of myofascial mobilization and osteopathic techniques in patients with non-specific low back pain and neck pain. Arguisuelas et al (2017)[13] evaluated and followed 4 myofascial mobilization methods in 4 different anatomical regions in people with non-specific CLBP and found positive interference on pain after 4 sessions of intervention in 2 weeks. Although the findings were positive for improving pain and functionality, the techniques, the muscles chosen for the application, the measures of pain results and the methodology of both works presented some limitations and were different from those used in the present study.

About functionality, the ODI questionnaire revealed that the individuals did not show a function reduction before and after the investigations. Lauridsen et al. (2006)[25] evaluated the response capacity and MCID of ODI for patients with CLBP and pointed out that a worsening greater than 12 points and an improvement greater than 13 points are clinically significant. They also considered that the best effect is with scores above 14%. In the current research, it was found an average score above 16% and no individual reached MCID, although the factorial analysis revealed a difference between the tests, no statistical significance by the Tukey post hoc multiple comparison tests was observed. In addition, in the present investigation, the interval between application of the questionnaires was 24 hours, which probably influenced the results obtained, as it reduced confounding and memory factors, beyond isolating the natural course over time, since the objective was to evaluate the technique effectiveness acutely. The article on the development of the Brazilian version of the ODI [40] (Vigatto, 2007) discusses this interference of the retest time in the results, also informs that a longer interval improves the chances of reducing the final percentage due to the influence of the natural course of the associated CLBP symptoms.

The time factor calls into question the need to follow-up, because in addition to the natural course of low back pain, it is known that a short-term MT intervention can improve pain and disability, but without retention effects after three-months follow-up [41] (Boff et al., 2019). Nevertheless, habitual loading will result in a high rate of collagen synthesis in a basal state simply as a result of a constant effect of loading from the previous 24-48h. Magnusson and cols. (2010)[42] observed that after cessation of exercise and up to 18-36h thereafter there is a negative net balance in collagen levels, whereas the balance is positive for up to 72h after exercise. However, the connective tissue requires a certain restitution period, since, without sufficient rest, a continuous loss of collagen is likely to occur, which might render the tissue vulnerable. Habitual physical exercises thus results in a higher turnover of collagen, whereas inactivity lowers collagen synthesis and turnover [42] (Magnusson et al., 2010).

According to the literature, physical exercises are the most used resources in conservative treatment and in the prevention of chronic pain, being performed in different modalities, duration and intensity according to the complaint, health status and final objective, in addition to being associated with multimodal or multidisciplinary treatments [8,9,43–45] (Hayden et al, 2005; Middelkoop et al., 2010; Searle et al., 2015; Gomes et al., 2017; Coulombe et al, 2017). In this work, the performance of physical exercises, according to the level of physical activity self-reported by the sample, may also have been interference in the outcomes. 44% of the sample considered themselves active, but doing vigorous exercise less than 3 times per week, or moderate physical activity less than 5 times per week, this information do not meet the guidelines of the American College of Sports Medicine for health benefits [26] (Martin et al, 2000). Even though the level of physical activity is not significant, this information may have influenced the results.

Ajimsha et al (2013)[12] showed that myofascial mobilization was essential for the effectiveness of specific exercises in pain and functionality in subjects with CLBP. In this case, subjects underwent 3 sessions for 8 weeks of specific exercises and received guidance on pain education. Only one group performed the myofascial mobilization techniques while the other received light manual touches in the same areas. According to the results of the investigation it is possible to infer that myofascial mobilization was only supporting the attenuation of CLBP symptoms, requiring the association of specific exercises. Furthermore, a longer treatment may be more effective, as

demonstrated by previous evidence [12,13] (Ajimsha et al., 2013; Arguissuelas, 2017). However, time-dependent analyzes were beyond the scope of this study, which can be seen as a limitation.

Studies have shown that movements and mechanical stimulus in the lumbar spine can improve movement, facilitate muscle control, reduce inflammatory tissue factors and produce immediate neurophysiological changes in sympathetic nervous system function and the endogenous pain inhibitory systems [21,38,46] (Cholewicki 2019; Puentedura and Flynn 2016; Bishop et al., 2015). Recent research about fascial system showed that it has a high level of adaptability responding to changes in internal and external conditions. The fascial system is also able to change its shape and manage changes in movement and different regulations of body functions [22,47,48] (Zugel 2018; Hodges 2019; Bordoni 2017). These therapeutic effects can occur in remote areas of the intervention, as well as pain could be the result of a tissue alteration distant from the reporting region according to the tensegrity model. Segmental or autonomic effects occur after stimulations on reflex zone of connective tissue. The accompanying autonomic effects of MT can be powerful and overdosing must be avoided [21,49,50] (Holey e Dixon, 2013; Bishop et al., 2015; Turvey & Fonseca; 2014).

Myofascial release, even as other MT techniques, is always accompanied by several benefits reaffirmed by those who use and receive it, providing it with an always effective label. This reinforces the patient's belief and perception of the intervention, and a complex set of physical and psychological stimuli that can influence their outcome, as well as the interaction between the therapist and the patient and the expectation of both in the treatment [21,38,51,52] (Bialosky et al. , 2017; Puentedura and Flynn, 2016; Wiech et al., 2008; Bishop et al., 2015).

These findings are not surprising, as the prognosis of pain is influenced by other factors further the scope of this work. The multi-causality and variety of outcomes presented by chronic pain, as well as the presence of symptoms related to central sensitization in these patients in addition to the non-linear interaction arising from the complexity of the interaction of causal factors, may explain a single session of myofascial mobilization was not enough to modify the threshold and intensity of the pain and functional capacity [46,53,54] (Bittencourt et al., 2016; Cholewicki 2019; Huysmans et al., 2018).

Considering these facts, it is consensus that non-specific CLBP has biological, psychological and social components in several different extensions, above the role of biomechanics in its development. It must be considered that each subject has different painful experiences and different outcomes throughout life, where multiple areas of the brain are activated during a pain experience [21,55] (Mertens, 2015; Bishop et al., 2015). Moreover, these central areas have other primary functions, i.e., movement execution, sensory location, and emotional awareness are overloaded in chronic pain, and may explain the emergence of psychosocial problems among other motor and sensory changes [38,55,56] (Mertens, 2015; Puentedura and Flynn, 2016; Wallwork, 2016). Additionally, a rehabilitation program focused not only on tissue but also on complementary issues such as exercise, pain education and behavioral strategies is important [38,46,52,57,58]. (Puentedura and Flynn, 2016; Louw, 2019; Wood, 2019; Cholewicki, 2019; Wiech, 2008)

5. Limitations

The largest sample had a low risk of poor prognosis to SBST, which proved to be an important limitation for obtaining results on pain and disability outcomes. In addition, the interval between experimental situations was very short in relation to the time of tissue adaptation, in addition to the ODI showing better results in reapplication when there is interference in the natural course of CLBP.

According to the baseline, part of the sample performed some type of physical exercise, which is a factor that may have contributed to the SBST classification and to the final results, since the exercises are positive for chronic pain.

No consecutive sessions were analyzed, as the aim of the research was to verify immediate results of fascial mobilization and the time of the technique may have been short to obtain a positive result, therefore a time-dependent analysis with follow up would be more appropriate.

6. Final considerations

This study provides evidence that a single trial of thoracolumbar myofascial release technique was not enough to reduce pain and disability in subjects with CLBP. Further investigations associating other interventions with myofascial mobilization are required, as well as prolonged treatments. The mechanisms underlying these responses merit further investigation. As a perspective, we suggest the design of studies with an approach to the biopsychosocial aspects presented by individuals with CLBP, besides analyzing the effects of myofascial mobilization at the structural level of the tissue.

Authors' contributions: Project methodology and administration: Lacerda, A.C.R. and Martins, F.L.M .; data validation, curation and investigation: Paulo, L.R .; formal analysis, Fernandes, J.S.C .; conceptualization: Guimarães, C.Q. and Vieira, L.S .; visualization and writing — preparation of the original draft: Paulo, L.R .; writing — proofreading and editing: Mendonça, V.A., Lacerda, A.C.R., Fonseca, S.F., Oliveira, M.X., Taiar, R., Anjos, M.T.S. and Martins, F.L.M .; supervision: Martins, F.L.M .; financial support: Paulo, L.R., Aguiar, P.A.T. and Ballesteros, S.S.G.

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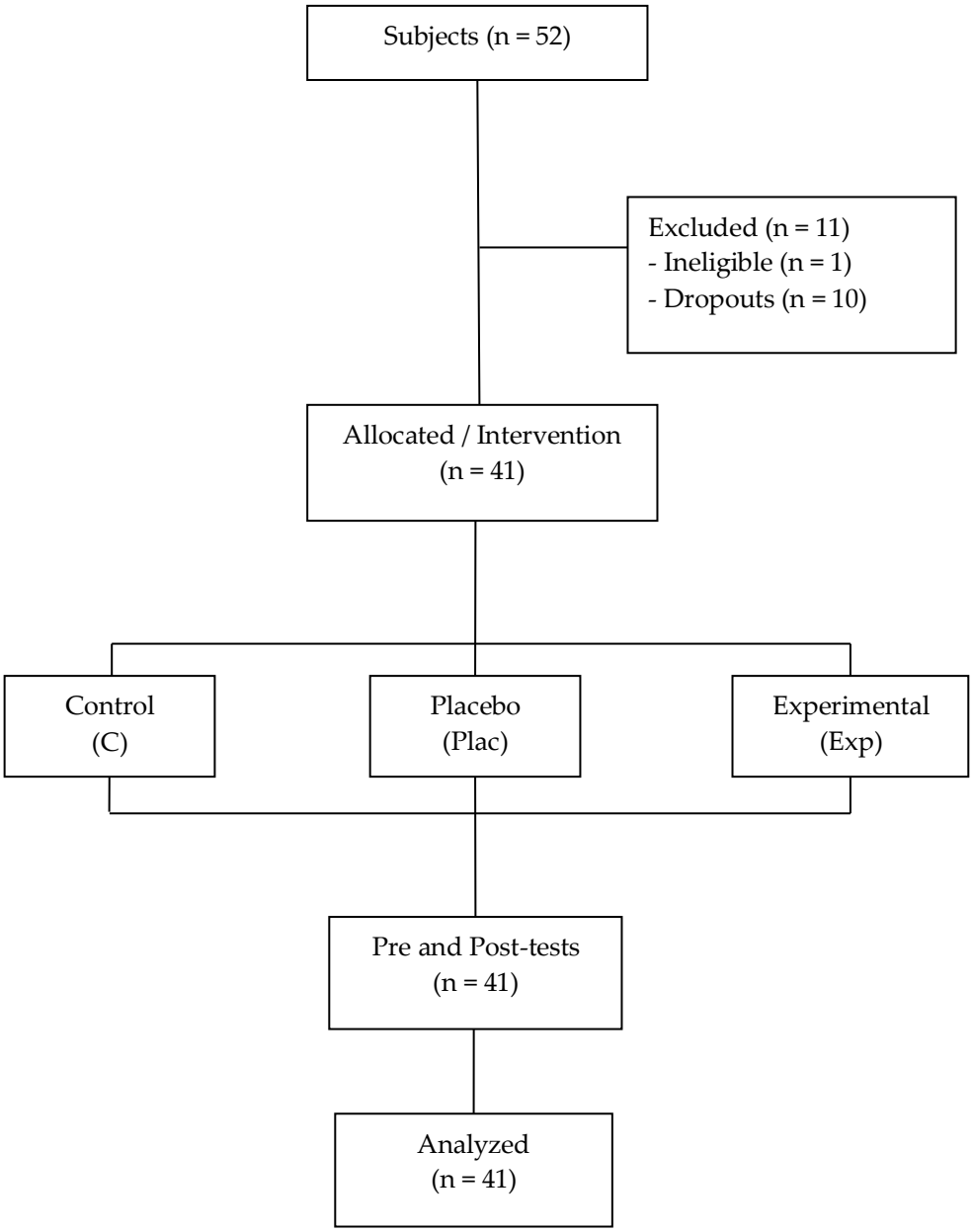
Conflict of interest: the authors declare that there is no conflict of interest.

7 Appendix A

Figure A1. Flowchart of subjects



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Anexo A: Oswestry Disability Index - Versão 2.0

Por favor, você poderia completar este questionário? Ele foi desenvolvido para nos dar informações de como seu problema nas costas têm afetado suas atividades de vida diária. Por favor, responda a todas as seções. Marque apenas um quadrado em cada seção, aquele que descreve claramente sua condição no dia de hoje.

Seção 01: Intensidade da dor:

- □ Não sinto dor no momento
- □ A dor é muito leve no momento
- □ A dor é moderada no momento
- □ A dor é razoavelmente intensa no momento
- □ A dor é muito intensa no momento
- □ A dor é a pior que se pode imaginar no momento

Seção 02: Cuidados pessoais

- □ Posso cuidar de mim mesmo normalmente sem que isso aumente a dor
- □ Posso cuidar de mim mesmo normalmente, mas sinto muita dor
- □ Sinto dor ao cuidar de mim mesmo e faço isso lentamente e com cuidado
- □ Necessito de alguma ajuda, porém consigo fazer a maior parte dos meus cuidados pessoais
- □ Necessito de ajuda diária na maioria dos aspectos de meus cuidados pessoais
- □ Não consigo me vestir, lavo-me com dificuldade e permaneço na cama.

Seção 03: Levantar objetos

- □ Consigo levantar objetos pesados sem aumentar a dor
- □ Consigo levantar objetos pesados, mas isso aumenta a minha dor
- □ A dor me impede de levantar objetos pesados do chão, mas consigo levantá-los se estiverem convenientemente posicionados, por exemplo, sobre uma mesa
- □ A dor me impede de levantar objetos pesados, mas consigo levantar objetos leves a moderados, se estiverem convenientemente posicionados
- □ Consigo levantar apenas objetos muito leves
- □ Não consigo levantar ou carregar absolutamente nada

Seção 04: Caminhar

- □ A dor não me impede de caminhar qualquer distância
- □ A dor me impede de caminhar mais de 1600 metros (aproximadamente 16 quarteirões de 100 metros)
- □ A dor me impede de caminhar mais de 800 metros (aproximadamente 8 quarteirões de 100 metros)
- □ A dor me impede de caminhar mais de 400 metros (aproximadamente 4 quarteirões de 100 metros)
- □ Só consigo andar usando uma bengala
- □ Fico na cama a maior parte do tempo e preciso me arrastar para ir ao banheiro

Seção 05: Sentar

- □ Consigo sentar em qualquer tipo de cadeira durante o tempo que quiser
- □ Consigo sentar em uma cadeira confortável durante o tempo que quiser
- □ A dor me impede de ficar sentado por mais de 1 hora
- □ A dor me impede de ficar sentado por mais de meia hora
- □ A dor me impede de ficar sentado por mais de 10 minutos
- □ A dor me impede de sentar

Seção 06: Ficar em pé

- □ Consigo ficar em pé o tempo que quiser sem que isso aumente a dor
- □ Consigo ficar em pé o tempo que quiser, mas isso aumenta a dor
- □ A dor me impede de ficar em pé por mais de 1 hora
- □ A dor me impede de ficar em pé por mais de meia hora
- □ A dor me impede de ficar em pé por mais de 10 minutos
- □ A dor me impede de ficar em pé

Seção 07: Dormir/Sono

- □ Meu sono nunca é perturbado pela dor
- □ Meu sono é ocasionalmente perturbado pela dor
- □ Durmo menos de 6 horas por causa da dor
- □ Durmo menos de 4 horas por causa da dor
- □ Durmo menos de 2 horas por causa da dor
- □ A dor me impede totalmente de dormir

Seção 08: Vida sexual

- □ Minha vida sexual é normal e não aumenta minha dor
- □ Minha vida sexual é normal, mas causa um pouco mais de dor
- □ Minha vida sexual é quase normal, mas causa muita dor
- □ Minha vida sexual é severamente limitada pela dor
- □ Minha vida sexual é quase ausente por causa da dor
- □ A dor me impede de ter uma vida sexual

Seção 09: Vida social

- □ Minha vida social é normal e não aumenta a dor
- □ Minha vida social é normal, mas causa um pouco mais de dor
- □ A dor não tem nenhum efeito significativo na minha vida social, porém limita alguns interesses que demandam mais energia, como por exemplo, esporte, etc,
- □ A dor tem restringido minha vida social e não saio de casa com tanta frequência
- □ A dor tem restringido minha vida social ao meu lar
- □ Não tenho vida social por causa da dor

Seção 10: Locomoção (ônibus/carro/táxi)

□ Posso ir a qualquer lugar sem sentir dor
□ Posso ir a qualquer, mas isso aumenta a dor
□ A dor é intensa, mas consigo me locomover durante 2 horas
□ A dor restringe-me a locomoções de menos de 1 hora
□ A dor restringe-me a pequenas locomoções necessárias de menos de 30 minutos
□ A dor impede de locomover-me, exceto para receber tratamento

Anexo B: SBST-Brasil

STarT Back Screening Tool – Brasil (SBST-Brasil)
Pensando nas duas últimas semanas, assinale sua resposta para as seguintes perguntas:

	Discordo (0)	Concordo (1)
1. A minha dor nas costas se espalhou pelas pernas nas duas últimas semanas	( )	( )
2. Eu tive dor no ombro e/ou na nuca pelo menos uma vez nas duas últimas semanas	( )	( )
3. Eu evito andar longas distâncias por causa da minha dor nas costas	( )	( )
4. Nas duas últimas semanas, tenho me vestido mais devagar por causa da minha dor nas costas	( )	( )
5. A atividade física não é realmente segura para uma pessoa com problema como o meu,	( )	( )
6. Tenho ficado preocupado por muito tempo por causa da minha dor nas costas,	( )	( )
7. Eu sinto que minha dor nas costas é terrível e que nunca vai melhorar,	( )	( )
8. Em geral eu não tenho gostado das coisas como eu costumava gostar,	( )	( )
9. Em geral, quanto a sua dor nas costas o incomodou nas duas últimas semanas,	( ) Nada (0) ( ) Pouco (0) ( ) Moderado (0) ( ) Muito (1) ( ) Extremamente (1)	
Pontuação total (9 itens): _____ Subescala psicossocial (5-9 itens):_____		

Anexo C: Normas da Revista Applied Science (MDPI)

Type of the Paper (Article, Review, Communication, etc.)

Title

Firstname Lastname [1], Firstname Lastname [2] and Firstname Lastname [2,*]

[1] Affiliation 1; e-mail@e-mail.com
[2] Affiliation 2; e-mail@e-mail.com
* Correspondence: e-mail@e-mail.com; Tel.: (optional; include country code; if there are multiple corresponding authors, add author initials) +xx-xxxx-xxx-xxxx (F.L.)

Received: date; Accepted: date; Published: date

Featured Application: Authors are encouraged to provide a concise description of the specific application or a potential application of the work. This section is not mandatory.

Abstract: A single paragraph of about 200 words maximum. For research articles, abstracts should give a pertinent overview of the work. We strongly encourage authors to use the following style of structured abstracts, but without headings: (1) Background: Place the question addressed in a broad context and highlight the purpose of the study; (2) Methods: Describe briefly the main methods or treatments applied; (3) Results: Summarize the article's main findings; and (4) Conclusions: Indicate the main conclusions or interpretations. The abstract should be an objective representation of the article, it must not contain results which are not presented and substantiated in the main text and should not exaggerate the main conclusions.

Keywords: keyword 1; keyword 2; keyword 3 (List three to ten pertinent keywords specific to the article; yet reasonably common within the subject discipline.)

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0. How to Use This Template

The template details the sections that can be used in a manuscript. Note that each section has a corresponding style, which can be found in the 'Styles' menu of Word. Sections that are not mandatory are listed as such. The section titles given are for Articles. Review papers and other article types have a more flexible structure.

Remove this paragraph and start section numbering with 1. For any questions, please contact the editorial office of the journal or support@mdpi.com.

1. Introduction

The introduction should briefly place the study in a broad context and highlight why it is important. It should define the purpose of the work and its significance. The current state of the research field should be reviewed carefully and key publications cited. Please highlight controversial and diverging hypotheses when necessary. Finally, briefly mention the main aim of the work and highlight the principal conclusions. As far as possible, please keep the introduction comprehensible to scientists outside your particular field of research. References should be numbered in order of appearance and indicated by a numeral or numerals in square brackets, e.g., [1] or [2,3], or [4–6]. See the end of the document for further details on references.

2. Materials and Methods

Materials and Methods should be described with sufficient details to allow others to replicate and build on published results. Please note that publication of your manuscript implicates that you must make all materials, data, computer code, and protocols associated with the publication available to readers. Please disclose at the submission stage any restrictions on the availability of materials or information. New methods and protocols should be described in detail while well-established methods can be briefly described and appropriately cited.

Research manuscripts reporting large datasets that are deposited in a publicly available database should specify where the data have been deposited and provide the relevant accession numbers. If the accession numbers have not yet been obtained at the time of submission, please state that they will be provided during review. They must be provided prior to publication.

Interventionary studies involving animals or humans, and other studies require ethical approval must list the authority that provided approval and the corresponding ethical approval code.

3. Results

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation as well as the experimental conclusions that can be drawn.

3.1. Subsection

3.1.1. Subsubsection

Bulleted lists look like this:

- First bullet
- Second bullet
- Third bullet

Numbered lists can be added as follows:

1. First item
2. Second item
3. Third item

The text continues here.

3.2. Figures, Tables and Schemes

All figures and tables should be cited in the main text as Figure 1, Table 1, etc.

(**a**) (**b**)

Figure 1. This is a figure, Schemes follow the same formatting. If there are multiple panels, they should be listed as: (**a**) Description of what is contained in the first panel; (**b**) Description of what is contained in the second panel. Figures should be placed in the main text near to the first time they are cited. A caption on a single line should be centered.

Table 1. This is a table. Tables should be placed in the main text near to the first time they are cited.

Title 1	Title 2	Title 3
entry 1	Data	data
entry 2	Data	data [1]

[1] Tables may have a footer.

3.3. Formatting of Mathematical Components

This is an example of an equation:

$$a = 1, \tag{1}$$

the text following an equation need not be a new paragraph. Please punctuate equations as regular text.

4. Discussion

Authors should discuss the results and how they can be interpreted in perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

5. Conclusions

This section is not mandatory, but can be added to the manuscript if the discussion is unusually long or complex.

6. Patents

This section is not mandatory, but may be added if there are patents resulting from the work reported in this manuscript.

Supplementary Materials: The following are available online at www.mdpi.com/xxx/s1, Figure S1: title, Table S1: title, Video S1: title.

Author Contributions: For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, X.X. and Y.Y.; methodology, X.X.; software, X.X.; validation, X.X., Y.Y. and Z.Z.; formal analysis, X.X.; investigation, X.X.; resources, X.X.; data curation, X.X.; writing—original draft preparation, X.X.; writing—review and editing, X.X.; visualization, X.X.; supervision, X.X.; project administration, X.X.; funding acquisition, Y.Y. All authors have read and agreed to the published version of the manuscript.", please turn to the CrediT taxonomy for the term explanation. Authorship must be limited to those who have contributed substantially to the work reported.

Funding: Please add: "This research received no external funding" or "This research was funded by NAME OF FUNDER, grant number XXX" and "The APC was funded by XXX". Check carefully that the details given are accurate and use the standard spelling of funding agency names at https://search.crossref.org/funding, any errors may affect your future funding.

Acknowledgments: In this section you can acknowledge any support given which is not covered by the author contribution or funding sections. This may include administrative and technical support, or donations in kind (e.g., materials used for experiments).

Conflicts of Interest: Declare conflicts of interest or state "The authors declare no conflict of interest." Authors must identify and declare any personal circumstances or interest that may be perceived as inappropriately influencing the representation or interpretation of reported

research results. Any role of the funders in the design of the study; in the collection, analyses or interpretation of data; in the writing of the manuscript, or in the decision to publish the results must be declared in this section. If there is no role, please state "The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results".

Appendix A

The appendix is an optional section that can contain details and data supplemental to the main text. For example, explanations of experimental details that would disrupt the flow of the main text, but nonetheless remain crucial to understanding and reproducing the research shown; figures of replicates for experiments of which representative data is shown in the main text can be added here if brief, or as Supplementary data. Mathematical proofs of results not central to the paper can be added as an appendix.

Appendix B

All appendix sections must be cited in the main text. In the appendixes, Figures, Tables, etc. should be labeled starting with 'A', e.g., Figure A1, Figure A2, etc.

References

References must be numbered in order of appearance in the text (including citations in tables and legends) and listed individually at the end of the manuscript. We recommend preparing the references with a bibliography software package, such as EndNote, ReferenceManager or Zotero to avoid typing mistakes and duplicated references. Include the digital object identifier (DOI) for all references where available.

Citations and References in Supplementary files are permitted provided that they also appear in the reference list here.

In the text, reference numbers should be placed in square brackets [ ], and placed before the punctuation; for example [1], [1–3] or [1,3]. For embedded citations in the text with pagination, use both parentheses and brackets to indicate the reference number and page numbers; for example [5] (p. 10), or [6] (pp. 101–105).

59. Author 1, A.B.; Author 2, C.D. Title of the article. *Abbreviated Journal Name* **Year**, *Volume*, page range.
60. Author 1, A.; Author 2, B. Title of the chapter. In *Book Title*, 2nd ed.; Editor 1, A., Editor 2, B., Eds.; Publisher: Publisher Location, Country, 2007; Volume 3, pp. 154–196.
61. Author 1, A.; Author 2, B. *Book Title*, 3rd ed.; Publisher: Publisher Location, Country, 2008; pp. 154–196.
62. Author 1, A.B.; Author 2, C. Title of Unpublished Work. *Abbreviated Journal Name* stage of publication (under review; accepted; in press).
63. Author 1, A.B. (University, City, State, Country); Author 2, C. (Institute, City, State, Country). Personal communication, 2012.
64. Author 1, A.B.; Author 2, C.D.; Author 3, E.F. Title of Presentation. In Title of the Collected Work (if available), Proceedings of the Name of the Conference, Location of Conference, Country, Date of Conference; Editor 1, Editor 2, Eds. (if available); Publisher: City, Country, Year (if available); Abstract Number (optional), Pagination (optional).
65. Author 1, A.B. Title of Thesis. Level of Thesis, Degree-Granting University, Location of University, Date of Completion.
66. Title of Site. Available online: URL (accessed on Day Month Year).

Anexo D: Aprovação Comitê de Ética

UNIVERSIDADE FEDERAL DOS VALES DO JEQUITINHONHA E MUCURI

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: EFEITOS AGUDOS DA MOBILIZAÇÃO FASCIAL TÓRACO-LOMBAR NA DOR E NA FUNCIONALIDADE DE INDIVÍDUOS COM LOMBALGIA CRÔNICA: ENSAIO CLÍNICO CONTROLADO CRUZADO

Pesquisador: Fábio Luiz Mendonça Martins

Área Temática:

Versão: 1

CAAE: 16609019.0.0000.5108

Instituição Proponente: Universidade Federal dos Vales do Jequitinhonha e Mucuri

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 3.435.537

UNIVERSIDADE FEDERAL DOS VALES DO JEQUITINHONHA E MUCURI

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

DIAMANTINA, 03 de Julho de 2019

Assinado por:
Simone Gomes Dias de Oliveira
(Coordenador(a))