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**A ALTERAÇÃO DO CONTROLE MOTOR E FORÇA MUSCULAR DOS
MEMBROS INFERIORES PODE PROMOVER O SURGIMENTO DA DOR
FEMOROPATELAR?**

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Trabalho de Conclusão apresentado ao curso de Fisioterapia da Universidade Federal de Sergipe, como requisito para conclusão do curso de graduação em Fisioterapia.

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AGRADECIMENTOS

Agradecer é o ato de reconhecer que não se faz nada sozinha.

Ao meu orientador Paulo Marcio, por exigir meu máximo sempre e ser fonte inesgotável de inspiração profissional e pessoal.

À minha companheira de pesquisa e amiga querida Carla Nunes, obrigada por ter sido freio e impulso na hora certa.

Aos dedicados voluntários Jakeline Cruz, Jonathan Mendonça, Milena Silva, Renatta Messias e Vilmara Nogueira, que equipe!

À professora Paula Nunes, pelas noções de estatística e apoio dado.

Ao corpo docente e discente do CEPARD, pela acolhida e apoio.

E mais importante, agradeço a Deus pela força e o discernimento de chegar até aqui e ter colocado todas essas pessoas em meu caminho durante essa jornada.

RESUMO

Souza, Camila Santos; Oliveira, Paulo Márcio Pereira. A alteração do controle motor e força dos membros inferiores pode promover o surgimento da dor femuropatelar? Universidade Federal de Sergipe. 2018.

Introdução: A Dor Femoropatelar (DFP) refere-se à dor atrás ou ao redor da patela, agravada por atividades que sobrecarreguem a articulação do joelho durante o suporte de peso. **Objetivo:** Comparar o controle motor, a força de quadril, joelho e pé das voluntárias com DFP com controles saudáveis; secundariamente, correlacionar e verificar a influência da força muscular no controle motor do membro inferior em mulheres com DFP. **Métodos:** estudo de delineamento transversal, aprovada pelo comitê de ética e pesquisa da UFS (CAAE: 68030117.3.0000.5546) e realizada com 30 mulheres distribuídas em 02 grupos (sintomático e assintomático). O controle motor foi avaliado através do Star Excursion Balance Test (SEBT), nas direções anterior (A), pósteromedial (PM) e pósterolateral (PL). A força muscular foi aferida com o dinamômetro digital manual, através da contração isométrica voluntária máxima (CIMV). **Resultados:** Foi observada redução da força dos flexores do joelho ($p=0,01$) e tibial posterior ($p=0,01$), bem como menor controle motor: anterior ($p=0,01$), pósteromedial ($p=0,01$) e pósterolateral ($p=0,01$), no grupo sintomático. Na análise de regressão verificou-se que a força do complexo posterolateral do quadril ($p=0,02$) e dos extensores do joelho ($p=0,02$) influenciam no controle motor PL, enquanto a força do abdutor do hálux ($p=0,01$) influencia na direção PM. **Conclusão:** Mulheres com DFP apresentam redução de força muscular de flexores de joelho e tibial posterior. A força do CPLQ, extensores do joelho, tibial posterior e abdutor do hálux influenciam no controle motor dos membros inferiores, nas direções PM e PL.

Palavras-chave: Síndrome da dor patelofemoral, equilíbrio postural, controle do pé, força muscular.

ABSTRACT

Souza, Camila Santos; Oliveira, Paulo Márcio Pereira. Alteration of motor control and lower limb strength may promote the onset of patellofemoral pain? Universidade Federal de Sergipe. 2018.

Introduction: Patellofemoral pain (DPF) refers to pain behind or around the kneecap, compounded by activities that burden the knee joint during weight bearing. **Objective:** Compare the motor control, the strength of hip, knee and foot of the volunteers with DPF with healthy controls; secondarily, correlate and verify the influence of muscle strength in the lower limb motor control in women with DPF. **Methods:** Cross-sectional delineation study, approved by the ethics and Research Committee of the UFS (68030117.3.0000.5546) and performed with 30 women in group 02 (symptomatic and asymptomatic). Motor control was evaluated through the Star Excursion Balance Test (SBET), directions previous (A), posterior medialis (PM) and posterior side (PL). Muscle strength was measured with the manual digital dynamometer, through the maximum voluntary isometric contraction (CIMV). **Results:** It was observed a reduction in the strength of the flexors of the knee ($p=0,01$) and tibialis posterior ($p=0.01$), as well as smaller motor control previous ($p=0.01$), posterior medialis ($p=0.01$) and posterior ($p=0.01$) in the symptomatic group. In regression analysis it was found that the strength of the posterolateral complex of the hip ($p=0.02$) and knee extensor ($p=0.02$) influence on motor control PL, while the strength of the abductor hallucis ($p=0.01$) influences towards PM. **Conclusion:** Women with DPF feature reduction of muscle strength of knee flexors and tibialis posterior. The strength of the knee extensors, CPLQ, posterior tibial and abductor hallucis influence in motor control of inferiores members, in the directions PM and PL.

Keywords: star excursion balance test; patellofemoral pain syndrome, postural balance, foot control, muscle strength.

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1. INTRODUÇÃO

A Dor Femoropatelar (DFP) refere-se à dor atrás ou ao redor da patela, agravada por atividades que sobrecarregue a articulação do joelho durante o suporte de peso⁷. Sua incidência é maior em adolescentes e adultos jovens do sexo feminino^{7,42}. Atualmente são escassas as pesquisas que analisam o controle motor dos membros inferiores e sua influência no surgimento e desenvolvimento desta disfunção⁴⁴. Da mesma forma são poucos os estudos que investigaram a influência da fraqueza dos músculos dos membros inferiores e sua repercussão no controle motor de pacientes com DFP^{13,25,26,44}.

Portanto a alteração da força destas musculaturas podem repercutir negativamente na alteração da informação neurosensorial⁴⁰. Dessa forma, a fraqueza muscular contribui para o mau alinhamento dos membros inferiores e o surgimento da DFP^{12,38,41}. Os músculos de atuação intrínseca no pé são responsáveis pelo controle motor ao estabilizar o membro inferior e manter o equilíbrio corporal^{19,23,32}. Além disso, Powers³⁹ sugere que os indivíduos com DFP realizem compensações em decorrência da dor.

Até o momento, a grande maioria dos estudos científicos publicados sobre as alterações do pé e sua relação com a dor femoropatelar limitam-se a uma única medida: a pronação excessiva da articulação subtalar, comumente avaliada pelo teste de queda do navicular. Desconsiderando assim, a complexidade do pé em relação à força dos músculos que contribuem de forma direta para a formação do arco longitudinal medial, que também tem sido associada às lesões musculoesqueléticas dos membros inferiores^{20,31,32}.

Contrariamente à força dos músculos intrínsecos e extrínsecos do pé, existem inúmeros estudos publicados sobre a influência da força e equilíbrio muscular dos estabilizadores do quadril e joelho em pacientes com DFP^{7,14,19,34,36,42}. Entretanto, ainda pouco se conhece sobre a função dos músculos estabilizadores do quadril, do joelho e dos músculos dos pés e sua influência no controle motor dos membros inferiores em pacientes com esta disfunção musculoesquelética^{4,17,18,44}.

Embora tenha havido algumas tentativas recentes de determinar a influência dos déficits de força no controle motor do membro inferior, os resultados não abrangem a DFP. Além disso, os estudos disponíveis seguem uma tendência de avaliar apenas um grupo muscular ou articulação específica. Nesse contexto, avaliar

membro inferior torna-se indispensável para maior compreensão dos fatores de risco da DPF. Portanto o objetivo primário do estudo foi comparar o controle motor, a força do quadril, do joelho e pé dos voluntários portadores de DFP com controles saudáveis. E secundariamente correlacionar e verificar a influencia da força muscular no controle motor do membro inferior em mulheres com DFP.

2. MÉTODOS

2.1. Amostra

Esta pesquisa de delineamento transversal foi aprovada pelo Comitê de Ética em Pesquisa com Seres Humanos da Universidade Federal de Sergipe (número de protocolo CAAE 68030117.3.0000.5546). Foram coletadas informações de 30 mulheres, não atletas, com idade entre 15 e 25 anos, com índice de massa corpórea menor ou igual a 30 kg/m^2 . Dessa forma após a avaliação física, as mulheres foram alocadas em dois diferentes grupos de estudo: grupo sintomático (GS) e grupo assintomático (GA).

2.1.1. Seleção de participantes, critérios de inclusão e exclusão

As participantes foram recrutadas por meio de anúncio local no Colégio Estadual Abelardo Romero Dantas, Lagarto/Sergipe/Brasil, e não foi realizado teste probalístico para a seleção da amostra. Foram selecionadas as mulheres que se enquadraram nos critérios de inclusão. Toda a pesquisa foi realizada na Clínica Escola de Fisioterapia da UFS, campus Lagarto e foi iniciada após assinatura do Termo de Consentimento Livre e Esclarecido pelos sujeitos ou seus responsáveis legais.

No grupo sintomático, foram incluídas 15 mulheres em idade reprodutiva; presença de dor na região do joelho em, pelo menos, três das seguintes atividades: agachar por tempo prolongado, subir ou descer escadas, ajoelhar-se, correr, permanecer muito tempo sentada e contrair isometricamente o músculo quadríceps, com intensidade de dor maior que 02 (0-10) na Escala Numérica de Dor (NRS) durante a realização das atividades citadas anteriormente; escore menor que 82 na Escala de Dor Anterior do Joelho (EDAJ). Em caso de acometimento bilateral pela

disfunção femoropatelar, o membro avaliado foi determinado em detrimento do maior número de manifestações clínicas presentes.

O grupo assintomático foi composto por 15 mulheres saudáveis, sem qualquer história de dor, trauma, lesão meniscal ou ligamentar do joelho, doença neurológica ou do sistema osteomioarticular, cirurgia no joelho ou em membros inferiores. As mulheres incluídas neste grupo não poderiam apresentar dor durante a realização dos testes funcionais do degrau e agachamento; escore igual ou maior que 82 EDAJ. Neste grupo, o membro dominante, conforme determinado pelo relato da participante, foi considerado para análise.

Os critérios de exclusão compreenderam: uso de qualquer tratamento hormonal; doença do sistema imunológico ou neurológico; história de trauma nos membros inferiores, lesão meniscal ou ligamentar do joelho; luxação patelar recidivante; história de cirurgia de joelho ou em outras regiões dos membros inferiores; uso de relaxante muscular, fármacos inibidores ou estimulantes do SNC, comprometimento visual, auditivo e/ou do sistema vestibular; inaptidão para seguir ordens ou compreender as ferramentas de mensuração do estudo; realização de tratamento fisioterapêutico prévio (mínimo de seis meses); fumantes; usuárias de drogas e uso de medicação analgésica nas últimas 24 horas.

2.2. Protocolo Experimental

2.2.1. Pré-Teste

Os sujeitos receberam informações sobre os objetivos da pesquisa, os instrumentos utilizados, os comandos verbais a serem atendidos e demais procedimentos da coleta de dados. Em seguida, foram avaliados dados antropométricos como peso, medido através de balança analógica (Camry®), calibrada pelo Inmetro (Instituto Nacional de Metrologia, Normalização e Qualidade Industrial), e altura, mensurada por meio de fita métrica não flexível (Tramontina®).

2.3. Avaliação da dor e funcionalidade

2.3.1. Questionário

Foi utilizada a Escala de Dor Anterior do Joelho (EDAJ) que é um instrumento específico para a disfunção femoropatelar, validado e adaptado

transculturalmente para a população brasileira, composto por 13 perguntas fechadas relacionado a atividades como, presença de dor, inchaço, instabilidade e atrofia da coxa; andar, saltar e correr; subir e descer escadas e agachar. As categorias dentro de cada item são avaliadas e as respostas somadas resultam em um índice global, no qual pontuações próximas de 0 a 82 representam déficit funcional, e, de 82 a 100 representam ausência de disfunção⁸.

2.4. Controle motor

O controle motor foi avaliado através do dispositivo OctoBalance (OctoBalance, Check your MOtion, Albacete, Espanha), por meio do Star Excursion Balance Test (SEBT) que permite avaliar múltiplas direções, porém foi analisada apenas três nos membros inferiores (MMII): anterior (A), pósterio medial (PM) e pósterio lateral (PL). O sistema de medição é baseado em uma fita métrica extensora, que é magnetizada em cada direção para uma plataforma octogonal. Cada tentativa consistiu em empurrar o ponto marcado no topo da fita métrica, com a cabeça do 5º metatarso, tanto quanto possível na direção designada. Antes do início de cada ensaio, a fita métrica foi colocada a uma distância de 30 cm. Cada ensaio foi validado por uma inspeção visual para garantir que cada tentativa fosse realizada com os dedos no ponto marcado e o pé contralateral ao teste permanecesse inteiro na plataforma, com o calcanhar na linha de fronteira do octógono. As voluntárias foram instruídas a manter as mãos nos quadris, no nível da crista ilíaca, durante o teste. Com o objetivo de familiarização com o instrumento, o aquecimento foi seguido por quatro tentativas com cada perna (isto é, postura esquerda e postura direita). Três ensaios foram permitidos em cada perna com 10 segundos de recuperação passiva entre os ensaios¹⁶.

2.5. Força muscular

A avaliação da força muscular foi realizada através do dinamômetro manual digital (modelo 12-0381W, MicroFET 2, Hoggan Saúde®). A normalização da força muscular foi realizada de acordo com a seguinte padronização: força (em Newtons), multiplicada pelo braço de alavanca (em metros) e dividida pelo peso corporal (kg); logo, sendo representada pela unidade Nm/kg. Em todos os testes, foram realizadas

quatro repetições, sendo que o primeiro registro teve, como objetivo, apenas familiarizar o sujeito ao movimento. Nas três medidas seguintes foi registrada a força, e, posteriormente calculada a média aritmética dentre os três valores obtidos. Durante a execução do teste, foram usados os seguintes comandos verbais: “Prepara” (para o posicionamento do indivíduo), “Vai; força; força; força; relaxa” (para a realização do teste). Entre cada comando, teve um intervalo de um segundo, e de 60 segundos entre cada repetição. Todos os testes foram realizados bilateralmente em ambos os grupos descritos.

2.5.1. Complexo Posterolateral do Quadril (CPLQ)

O teste foi realizado com a participante em decúbito lateral, com ambas as coxas posicionadas a 45° de flexão do quadril e 90° de flexão do joelho, com o membro a ser testado superior ao membro oposto. O dinamômetro foi estabilizado com uma faixa inelástica 5 cm acima da articulação do joelho. A participante foi instruída a realizar uma Contração Isométrica Voluntária Máxima (CIMV) durante a abdução do quadril, sem perder o contato entre os pés durante o movimento.¹

2.5.2. Extensores do joelho

A participante foi posicionada em sedestação na maca, com a coluna reta e as mãos apoiadas na borda da maca. O dinamômetro digital manual foi estabilizado, com uma faixa inelástica, na porção anterior do terço distal da tíbia. Em seguida, foi solicitado ao paciente realizar a CIVM durante a extensão do joelho³⁵.

2.5.3. Flexores do joelho

A voluntária foi posicionada em decúbito ventral, com os tornozelos na borda da maca. O dinamômetro digital manual foi colocado na porção posterior do terço distal da tíbia, com uma faixa inelástica. O paciente foi orientado a realizar uma CIVM durante a flexão do joelho³⁵.

2.5.4. Tibial posterior

A voluntária foi posicionada em decúbito dorsal, tornozelo a 90° na borda da maca. O examinador estabilizou o membro inferior com uma mão acima da articulação do tornozelo, na região posterior. O dinamômetro foi, acoplado a uma faixa inelástica, posicionado na região medial do pé. Foi solicitada a realização de uma CIVM durante a flexão plantar e inversão do pé³⁵.

2.5.5. Abductor do hálux

A voluntária foi posicionada em decúbito dorsal, tornozelo a 90° com o pé na borda da maca. O examinador estabilizou firmemente o calcanhar e posicionou o dinamômetro, acoplado a uma faixa inelástica, na porção medial do hálux. Foi solicitada a realização de uma CIVM durante a abdução do hálux³⁵.

2.6. Análise estatística

As variáveis numéricas foram testadas quanto à distribuição de normalidade por meio do teste Shapiro-Wilk. Dados normais foram apresentados em média (M) e desvio padrão (DP). Para a análise dos dados entre os grupos, foi utilizado o teste de T de Student. Para a análise de correlações foram utilizados os testes de Pearson. A significância estatística foi estipulada em 5% ($P \leq 0,05$). Para todas as análises, foi utilizado o programa BioEstat® (versão 5.3).

3. RESULTADOS

3.1. Sujeitos

Trinta mulheres concluíram o estudo, quinze foram alocadas no grupo sintomático e assintomático, respectivamente. As variáveis idade, peso, altura e IMC não foram significativamente diferentes entre os grupos, expressando a homogeneidade da amostra. Diferentemente, a Escala de Escore da dor anterior do Joelho foi observada diferença significativa entre os grupos, com menor funcionalidade no grupo sintomático ($70,73 \pm 8,30$; $p=0,0001$) (**TABELA 1**).

TABELA 1. Características demográficas e antropométricas da amostra

Características	GRUPOS		
	GS	GA	P
Idade (anos)	16,60±0,91	16,80±1,12	0,46
Peso (Kg)	56,73±8,66	56,26±6,15	0,43
Altura (m)	1,61±0,05	1,61±0,08	0,39
IMC (Kg/m²)	21,52±3, 58	21,76±3,19	0,42
EDAJ	70,73±8,30	99,46±0,74	0,0001*

Valores expressos como média ± desvio padrão. O valor de p corresponde à comparação dos grupos. GS: Grupo Sintomático; GC: Grupo Assintomático; EDAJ: Escala de Dor Anterior do Joelho. Significância estatística: *p<0,05. Teste de T de Student para amostras independentes.

3.2. Comparações

3.2.1. Controle motor

Foi observada diferença significativa entre os grupos com redução do controle motor no grupo sintomático, na direção anterior (55,67±8.61, p=0,01), póstero medial (69,59±9,59, p=0,01) e póstero lateral (68,71±12,78, p=0,01) ao comparar com controle assintomático nas mesmas direções, (62,61±6.53, p=0,01; 77,68±9,11, p=0,01; 78,26±10.04, p=0,01), respectivamente. **(FIGURA 1).**

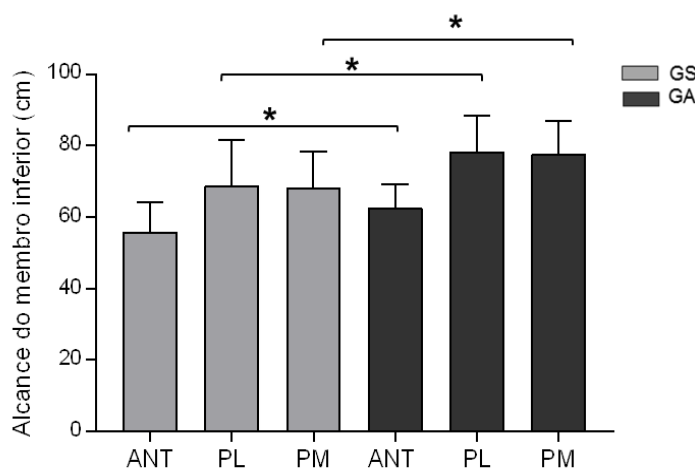


FIGURA 1. Controle motor nos grupos sintomático e assintomático. Valores expressos como média ± desvio padrão. O valor de p corresponde à comparação dos grupos. GS: grupo sintomático; GA: grupo assintomático; ANT: anterior; PL: póstero-lateral; PM: póstero-medial. Significância estatística: *p<0,05. Teste T de Student para medidas independentes.

3.2.1. Força Muscular

Não houve diferença estatística nas comparações entre os grupos em relação à força do CPLQ, extensores do joelho e abdutor do hálux. Diferentemente observou-se significância estatística com menor força no grupo sintomático, nos músculos flexores do joelho e tibial posterior (**TABELA 2**).

TABELA 2. Comparação da força muscular entre os grupos

Variáveis	GS	GA	P
CPLQ	271,83±88,63	338,19±128,44	0,18
Extensores do joelho	335,90±150,68	327,36±141,65	0,37
Flexores do joelho	211,83±82,49	306,32±144,02	0,01*
Tibial posterior	78,41±27,19	97,82±36,39	0,04*
Abdutor do hálux	42,84±16,02	43,20±11,18	0,49

Os valores foram apresentados como média $\pm$ desvio-padrão. Significância estatística: * $p < 0,05$. Teste T de Student para amostras independentes. CPLQ: complexo posterolateral do quadril, GS: grupo sintomático, GA: grupo assintomático.

Foi observado desequilíbrio muscular entre os flexores e extensores do joelho em 86,70% das participantes do grupo sintomático (**FIGURA 2**).

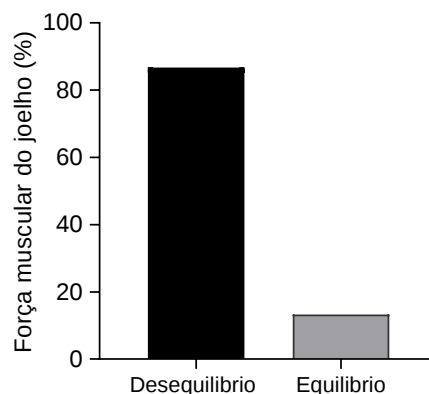


FIGURA 2. Razão entre a força dos flexores e extensores do joelho no GS. Valores expressos em porcentagem (%). Foi considerado desequilíbrio muscular valores fora da relação 2:1 entre extensores e flexores do joelho.

3.3. Correlações

Foi observada uma correlação regular, positiva com significância estatística entre o controle motor (PL) com a força do CPLQ e a força dos extensores do joelho

respectivamente. De forma similar aos resultados encontrados, foi visualizada uma correlação regular entre o controle motor (PM) e a força do abdutor do hálux (TABELA 3).

TABELA 3. Correlação entre as direções do SEBT e a força do membro inferior.

Controle Motor	CPLQ	Extensores do joelho	Flexores do joelho	Tibial Posterior	Abdutor do hálux
A	r:0,09 (p:0,73)	r:0,08 (p:0,75)	r:0,14 (p:0,60)	r:0,13 (p:0,63)	r:0,02 (p:0,92)
PL	r:0,56 (p:0,02)*	r:0,57 (p:0,02)*	r:0,14 (p:0,60)	r:0,25 (p:0,36)	r:0,46 (p:0,08)
PM	r:0,15 (p:0,57)	r:0,40 (p:0,12)	r:0,60 (p:0,81)	r:0,43 (p:0,10)	r:0,60 (p:0,01)*

Significância estatística: *p<0,05. r: Correlação de Pearson; CPLQ: complexo posterolateral do quadril; A: anterior, PL: pósterolateral; PM: pósteromedial.

3.4. Regressões

Foi observado que o controle motor (PL) é influenciado pela força do complexo posterolateral do quadril, extensores do joelho, tibial posterior e abdutor do hálux. De forma similar o controle motor (PM) é influenciado pela força do CPLQ, extensores do joelho e tibial posterior (TABELA 4).

TABELA 4: Análise univariada (r^2), entre direções do SEBT e força muscular.

VARIÁVEIS	Abdutor do hálux	Tibial Posterior	CPLQ	Extensores do joelho	Flexores do joelho
A	0,007 (p<0,65)	0,059 (p<0,19)	0,009 (p<0,93)	0,014 (p<0,52)	0,007 (p<0,66)
PL	0,153 (p<0,03)*	0,163 (p<0,02)*	0,173 (p<0,02)*	0,127 (p<0,05)*	0,109 (p<0,07)
PM	0,066 (p<0,17)	0,142 (p<0,04)*	0,103 (p<0,02)*	0,137 (p<0,04)*	0,160 (p<0,02)

Significância estatística: *p<0,05. A: anterior, PL: pósterolateral; PM: pósteromedial, CPLQ: complexo posterolateral do quadril.

4. DISCUSSÃO

Os resultados do presente estudo mostram que as mulheres com DFP apresentam menor controle motor dos membros inferiores quando comparados com

indivíduos saudáveis. Isto pode está relacionado às alterações decorrentes do quadro algico articular que repercutem em déficits proprioceptivos e mudanças no padrão de recrutamento muscular nos membros inferiores. Deste modo, diversas pesquisas afirmam haver uma forte relação entre os sistemas nervoso e musculoesquelético, no qual a presença do estímulo algico promove uma inadequada inter-relação entre os sistemas visual, vestibular e proprioceptivo, afetando o controle motor dos MMII^{4,9,10,21,25,30}.

Paralelamente, Plisky et al.³⁷ em seu estudo avaliaram 235 jogadores amadores de basquete. Nos seus resultados observaram que as mulheres que obtiveram um alcance inferior a 94,0% do comprimento do membro tinham 6,5 vezes mais chances de apresentarem lesões na extremidade inferior. Gribble et al.¹⁷ em sua revisão sistemática avaliaram estudos referentes ao uso clínico do SEBT para a quantificação das alterações de controle postural dinâmico de comprometimento de membros inferiores e concluíram que este é um bom instrumento para identificar déficits de controle motor e prever risco de lesões em membros inferiores dentre elas, a DFP.

De acordo com os resultados do presente estudo observou-se a redução da força muscular dos flexores e um importante desequilíbrio muscular entre agonistas e antagonistas do joelho nos voluntários com dor femoropatelar. Este fato pode ser justificado pela condição multifatorial da DFP, na qual os músculos de todo o membro inferior podem influenciar de forma isolada ou conjunta no surgimento e desenvolvimento desta disfunção pela existência de fraqueza e/ou desequilíbrio muscular. Sendo assim, Steidle et al.⁴⁶ e Mau-Moeller et al.²⁸, afirmam que a redução na força muscular decorre da mediação de sinais aferentes alterados nas articulações dolorosas, causando inibição neural da musculatura seja local e/ou distal a articulação afetada.

Curiosamente, os resultados deste estudo demonstraram haver homogeneidade entre os voluntários com e sem dor, em relação à força muscular dos extensores do joelho. De Oliveira et al.¹⁰ e Rathlef et al.⁴¹ nos seus estudos avaliaram mulheres com DFP, utilizando dinamômetro isométrico manual, através de uma Contração Isométrica Voluntária Máxima (CIVM). E nos seus resultados não foi observado déficit de força isométrica dos flexores e extensores de joelho entre os sujeitos sintomáticos e assintomáticos.

De maneira interessante, o tibial posterior (TP) apresentou diminuição da força muscular no grupo com DFP em comparação ao controle saudável. O TP é um importante músculo extrínseco com importante atuação no médio-pé, logo a fraqueza deste implica de maneira significativa no controle motor do membro inferior, devido à quebra da sua função de estabilização do arco plantar e controle da pronação excessiva^{23,31,32}. Em vista disso, Barton et al.³ relata que o pé excessivamente pronado evidencia uma ineficiência da estabilização dinâmica do arco plantar, sendo este um achado frequente na DFP. Portanto a alteração cinemática do membro inferior seja ascendente ou descendente promove o aumento do estresse da articulação femoropatelar, promovendo dor e aumento das repercussões biomecânicas negativas^{39,40}.

Os resultados do presente estudo demonstraram que existe uma importante e fundamental relação entre o controle motor dos membros inferiores em voluntários sintomáticos e a força dos músculos estabilizadores da articulação do quadril, joelho e pé. Isto em virtude da importância da força do complexo posterolateral do quadril e do quadríceps femoral, no controle da mecânica do membro inferior, durante atividades de descarga de peso nos planos frontais e sagitais, respectivamente.

Interessantemente os resultados do presente estudo demonstraram que o controle motor dos membros inferiores nas direções pósteromedial e lateral recebem influência de forma significativa da força do CPLQ e dos músculos intrínsecos e extrínsecos do pé. Isso pode acontecer em virtude do deslocamento anterior do centro de gravidade durante a execução do teste e consequente aumento da solicitação de controle neuromuscular distal e proximal. Lee et al.²⁶ avaliaram a relação entre a distância alcançada no SEBT e a força dos membros inferiores em mulheres e encontraram correlação entre a força dos extensores e abdutores do quadril e o controle motor.

Os músculos que atuam de forma intrínseca no pé desempenham um papel fundamental no controle postural e mantêm o equilíbrio durante a postura unipodal, controlando a altura do arco plantar medial e a pronação do pé¹³. Portanto, fornecem contribuições sensoriais e motoras e sua disfunção pode contribuir para o desenvolvimento de lesões por sobrecarga nos membros inferiores^{29,31}.

Cote et al.⁵ avaliaram a influência do tipo de pé, pronado, supinado ou neutro, no equilíbrio estático e dinâmico. Esses autores encontraram que os indivíduos com pronação excessiva apresentaram déficit de alcance nas direções

laterais do SEBT. Esses achados são apoiados pelos estudos de Koura et al.²⁴ que investigaram o efeito da pronação na estabilidade postural e Olmsted, Hertel³³ que examinaram os efeitos dos tipos de pé no controle postural, em 30 indivíduos.

Nesse contexto, desequilíbrios da musculatura intrínseca do pé têm sido colocados como fonte por alterações estruturais locais e distais e desordens no membro inferior²⁶, a exemplo dos flexores dos dedos^{2,15} e abdutor do hálux²². Paralelamente, Lee et al.²⁷ encontraram influência significativa da força do membro inferior no controle motor, nas direções anterior, pósteromedial e pósterolateral.

5. CONCLUSÃO

Mulheres com DFP apresentam redução de força muscular de flexores de joelho e tibial posterior. Conclui-se também que a força do CPLQ, extensores do joelho, tibial posterior e abdutor do hálux influenciam no controle motor, nas direções PM e PL.

6. CONSIDERAÇÕES FINAIS

Esse estudo apresentou algumas limitações relacionadas à amostra, como a recusa de participantes sob a alegação de demora nos testes e/ou não aceitar vestir roupas confortáveis necessárias para a avaliação. Isso repercutiu diretamente em outro aspecto, a quantidade de mulheres avaliadas. Paralelamente, a escassez de estudos atuais sobre força muscular intrínseca do pé e o controle motor dificulta a compreensão e a discussão a cerca dos achados. Porém, essa pesquisa abre espaço para novas investigações que busquem entender melhor essa relação e contribuir para a compreensão da função do pé no surgimento da DFP.

REFERÊNCIAS

1. Almeida GPL, das Neves Rodrigues HL, de Freitas BW, de Paula Lima PO. Reliability and Validity of the Hip Stability Isometric Test (HipSIT): A New Method to Assess Hip Posterolateral Muscle Strength. *J Orthop Sports Phys Ther.* 2017 ;47(12):906-913. <http://dx.doi.org/10.2519/jospt.2017.7274>.
2. Allen RH, Gross MT. Toe flexors strength and passive extension range of motion of the first metatarsophalangeal joint in individuals with plantar fasciitis. *J. Orthop.Sports Phys. Ther.* 2003;33:468–478. DOI: 10.2519 / jospt.2003.33.8.468.
3. Barton CJ, Bonanno D, Levinger P, Menz HB. Foot and Ankle Characteristics in Patellofemoral Pain Syndrome: A Case Control and Reliability Study. *J Orthop Sport Phys Ther.* 2010;40(5):286–96. Available from: <http://www.jospt.org/doi/10.2519/jospt.2010.3227>
4. Brenneman EC, Kuntz AB, Wiebenga EG, Maly MR. Does pain relate with activation of quadriceps and hamstrings muscles during strengthening exercise in people with knee osteoarthritis? *Springerplus.* 2016;5(1):1–9.
5. Cote KP, Michael E. Brunet ME, Gansneder BM, Shultz SJ. Effects of pronated and supinated foot postures on static and dynamic postural stability. *J Athl Train.* 2005; 40(1):41–46.
6. Chevidikunnan MF, Al Saif A, Gaowgzeh RA, Mamdouh KA. Effectiveness of core muscle strengthening for improving pain and dynamic balance among female patients with patellofemoral pain syndrome. *J Phys Ther Sci.* 2016;28(5):1518–23. Available from: https://www.jstage.jst.go.jp/article/jpts/28/5/28_jpts-2015-1051/_article.
7. Crossley, K. M. et al. 2016 Patellofemoral pain consensus statement from the 4th International Patellofemoral Pain Research Retreat, Manchester. Part 1: Terminology, definitions, clinical examination, natural history, patellofemoral osteoarthritis and patient-reported outcome measures. *British Journal of Sports Medicine*, p. 1-5, mar. 2016.
8. Cunha RA, Costa LOP, Hespanho Junior, LC, et al. Translation, Cross-cultural Adaptation, and Clinimetric Testing of Instruments Used to Assess Patients With Patellofemoral Pain Syndrome in the Brazilian Population. *J Orthop Sports Phys Ther.* 2013; 43 (5): 332–339 DOI: 10.2519/jospt.2013.4228
9. Delahunt E, Chawke M, Kelleher J, Murphy K, Prendiville A, Sweeny L, et al. Lower limb kinematics and dynamic postural stability in anterior cruciate ligament-reconstructed female athletes. *J Athl Train.* 2013;48(2):172–85.
10. De Oliveira DCS, Barboza SD, Da Costa FD, Cabral MP, Silva VMP, Dionisio VC. Can pain influence the proprioception and the motor behavior in subjects with mild and moderate knee osteoarthritis? *BMC Musculoskelet Disord.* 2014;15(1):1–8.

11. Endo Y, Sakamoto M. Relationship between Lower Extremity Tightness and Star Excursion Balance Test Performance in Junior High School Baseball Players. *J Phys Ther Sci.* 2014;26(5):661–3. Available from: <http://jlc.jst.go.jp/DN/JST.JSTAGE/jpts/26.661?lang=en&from=CrossRef&type=abstract>
12. Finnoff JT, Hall MM, Kyle K, et al. Hip strength and knee pain in high school runners: a prospective study. *PMR.* 2011;3:792–801. DOI: 10.1016 / j.pmrj.2011.04.007.
13. Fourchet F, Gojanovic B. Foot core strengthening: relevance in injury prevention and rehabilitation for runners. *Swiss Sports & Exercise Medicine.* 2016; 64 (1): 26–30.
14. Fok LA, Schache AG, Crossley KM, Lin YC, Pandy MG. Patellofemoral joint loading during stair ambulation in people with patellofemoral osteoarthritis. *Arthritis Rheum.* 2013;65(8):2059–2069.
15. Goldmann JP, Brüggemann GP. The potential of human toe flexor muscles to produce force. *J Anat.* 2012 ago; 221(2): 187-194. DOI:10.1111 / j.1469-7580.2012.01524.x.
16. Gonzalo-Skok O, Serna J, Rhea MR, Marín PJ. Relationships between functional movement tests and performance tests in young elite male basketball players. *Int J Sports Phys Ther.* 2015; 10(5): 628-638.
17. Gribble PA, Hertel J, Plisky P. Using the star excursion balance test to assess dynamic postural-control deficits and outcomes in lower extremity injury: A literature and systematic review. *J Athl Train.* 2012;47(3):339–57.
18. Gribble PA, Terada M, Beard MQ, Kosik KB, Lepley AS, McCann RS, et al. Prediction of Lateral Ankle Sprains in Football Players Based on Clinical Tests and Body Mass Index. *Am J Sports Med.* 2016;44(2):460–7.
19. Hart HF, Ackland DC, Pandy MG, Crossley KM. Quadriceps volumes are reduced in people with patellofemoral joint osteoarthritis. *Osteoarthritis Cartilage.* 2012;20(8):863–868
20. Headlle DL, , Leonard JL, Hart JM, et al. Fatigue of the plantar intrinsic foot muscles increases navicular drop. *J Electromyogr Kinesiol.* 2008; 18 (5): 420-25, DOI: 10.1016/j.jelekin.2006.11.004
21. Horak FB. Postural orientation and equilibrium: What do we need to know about neural control of balance to prevent falls? *Age Ageing.* 2006;35(SUPPL.2):7–11.
22. Jung DY, Kim MH, Koh EK, et al. A comparison in the muscle activity of the abductor hallucis and the medial longitudinal arch angle during toe curl and short foot exercises. *Phys Ther Sport.* 2011 feb;12(1):30-5. DOI: 10.1016/j.ptsp.2010.08.001. Epub 2010 Sep 15.
23. Kelly LA, Kuitunen S, Racinais S, et al. Recruitment of the plantar intrinsic foot

- muscles with increasing postural demand. *Clinical Biomechanics*. 2012; 27:46–51. DOI: 10.1016 / j.clinbiomech.2011.07.013.
24. Koura GM, Ayoub ED, Ahmed HH, et al. Impact of foot pronation on postural stability: An observational study. *J Back Musculoskelet Rehabil*. 2017; 30(6):1327-1332. DOI: 10.3233 / BMR-170886.
 25. Kwon YJ, Park SJ, Jefferson J, Kim K. The Effect of Open and Closed Kinetic Chain Exercises on Dynamic Balance Ability of Normal Healthy Adults. *J Phys Ther Sci*. 2013;25(6):671–4. Available from: <http://jlc.jst.go.jp/DN/JST.JSTAGE/jpts/25.671?lang=en&from=CrossRef&type=abstract>.
 26. Kwon OY, Tuttle LJ, Johnson JE, et al. Muscle imbalance and reduced ankle joint motion in people with hammer toe deformity. *Clin Biomech (Bristol, Avon)*. 2009; 24(8): 670–675. DOI:10.1016/j.clinbiomech.2009.05.010.
 27. Lee DK, Kang MH, Lee TS, Oh JS. Relationships among the Y balance test, Berg Balance Scale, and lower limb strength in middle-aged and older females. *Brazilian J Phys Ther*. 2015;19(3):227–34.
 28. Mau-Moeller A, Jacksteit R, Jackszis M, Feldhege F, Weippert M, Mittelmeier W, et al. Neuromuscular function of the quadriceps muscle during isometric maximal, submaximal and submaximal fatiguing voluntary contractions in knee osteoarthritis patients. *PLoS One*. 2017;12(5):1–21.
 29. Misu S, Doi T, Asai T, Sawa R, Tsutsumimoto K, Nakakubo S, et al. Association between toe flexor strength and spatiotemporal gait parameters in community-dwelling older people. *J Neuroeng Rehabil*. 2014;11(1):1–7.
 30. Miller EE, Whitcome KK, Lieberman DE, et al. The effect of minimal shoes on arch structure and intrinsic foot muscle strength. *J Sport Heal Sci*. 2014; 3: 74–85. DOI: 10.1016/j.jshs.2014.03.011.
 31. Mckeon, PO, Hertel J, Bramble D, Davis I. The foot core system: a new paradigm for understanding intrinsic foot muscle function. *British Journal of Sports Medicine*. 2014, 00:1 – 9. DOI: 10.1136 / bjsports-2013-092690.
 32. Mulligan EP, Cook PG. Effect of plantar intrinsic muscle training on medial longitudinal arch morphology and dynamic function. *Manual Therapy*. 2013; 18: 425-30. DOI: 10.1016/j.math.2013.02.007.
 33. Olmsted LC, Hertel J. Influence of Foot Type and Orthotics on Static and Dynamic Postural Control. *Journal of Human Kinetics*. 2004; 13(1): 54-66. DOI: 10.1123 / jsr.13.1.54
 34. Pappas E, Wong-Tom WM. Prospective Predictors of Patellofemoral Pain Syndrome: A Systematic Review With Meta-analysis. *Sports Health*. 2012;4(2):115–20.

35. Palmer ML, Epler ME. Fundamentos das técnicas de avaliação musculoesquelética. 2ed. Guanabara Koogan, Rio de Janeiro; 2015.
36. Petersen W, Rembitzki I, Liebau C. Patellofemoral pain in athletes. Open Access J Sport Med. 2017; 8:143–54. Available from: <https://www.dovepress.com/patellofemoral-pain-in-athletes-peer-reviewed-article-OAJSM>
37. Plisky PJ, Rauh MJ, Kaminski TW, Underwood FB. Star Excursion Balance Test as a Predictor of Lower Extremity Injury in High School Basketball Players. J Orthop Sport Phys Ther. 2006;36(12):911–9. Available from: <http://www.jospt.org/doi/10.2519/jospt.2006.2244>
38. Prins MR, van der Wurff P. Females with patellofemoral pain syndrome have weak hip muscles: a systematic review. Aust J Physiother 2009;55:9–15.
39. Powers CM. The Influence of Altered Lower-Extremity Kinematics on Patellofemoral Joint Dysfunction: A Theoretical Perspective. J Orthop Sport Phys Ther. 2003; 33(11): 639-46.
40. Powers CM. The Influence of Abnormal Hip Mechanics on Knee Injury: A Biomechanical Perspective. J Orthop Sport Phys Ther. 2010;40(2):42–51. Available from: <http://www.jospt.org/doi/10.2519/jospt.2010.3337>
41. Rathleff CR, Baird WN, Olesen JL, Roos EM, Rasmussen S, Rathleff MS. Hip and knee strength is not affected in 12-16 year old adolescents with patellofemoral pain - A cross-sectional population-based study. PLoS One. 2013;8(11):1–8.
42. Rathleff MS, Rathleff CR, Crossley KM, Barton CJ. Is hip strength a risk factor for patellofemoral pain? A systematic review and meta-analysis. Br J Sports Med. 2014;48(14):1088.
43. Roush J, Bay RC. Prevalence of anterior knee pain in 18-35 year-old females. J Orthop Sport Phys Ther. 2012; 7 (4): 396.
44. Soysa A, Hiller C, Refshauge C, et al. Importance and challenges of measuring intrinsic foot muscle strength. J Foot Ankle Res. 2012; 5(29). DOI: 10.1186/1757-1146-5-29.
45. Sozzi S, Honeine JL, Do MC, Schieppati M. Leg muscle activity during tandem stance and the control of body balance in the frontal plane. Clin Neurophysiol. 2013;124(6):1175–86. Available from: <http://dx.doi.org/10.1016/j.clinph.2012.12.001>
46. Steidle-Kloc E, Wirth W, Glass NA, Ruhdorfer A, Cotofana S, Eckstein F, et al. Is pain in one knee associated with isometric muscle strength in the contralateral limb? Data from the osteoarthritis initiative. Am J Phys Med Rehabil. 2015;94(10):792–803.

ANEXO 1: Aprovação do Comitê de Ética

UFS - UNIVERSIDADE FEDERAL DE SERGIPE 

COMPROVANTE DE ENVIO DO PROJETO**DADOS DO PROJETO DE PESQUISA**

Título da Pesquisa: ANÁLISE DO PERFIL BIOMECÂNICO EM MULHERES COM A SÍNDROME DA DOR PATELOFEMORAL (SDPF)

Pesquisador: Paulo Márcio Oliveira Pereira

Versão: 1

CAAE: 68030117.3.0000.5546

Instituição Proponente: Departamento de Fisioterapia - Lagarto

DADOS DO COMPROVANTE

Número do Comprovante: 045073/2017

Patrocinador Principal: Financiamento Próprio

Informamos que o projeto ANÁLISE DO PERFIL BIOMECÂNICO EM MULHERES COM A SÍNDROME DA DOR PATELOFEMORAL (SDPF) que tem como pesquisador responsável Paulo Márcio Oliveira Pereira, foi recebido para análise ética no CEP UFS - Universidade Federal de Sergipe em 08/05/2017 às 12:11.

ANEXO 2: Escala de Dor Anterior do Joelho (EDAJ)

BRAZILIAN PORTUGUESE VERSIONS OF THE INSTRUMENTS

ESCALA PARA DOR ANTERIOR DO JOELHO (EDAJ – AKPS)

Em cada questão, circule a letra que melhor descreve os atuais sintomas relacionados ao seu joelho.

1. Você caminha mancando?
 - a. Não
 - b. Levemente ou de vez em quando
 - c. Constantemente
2. O seu joelho suporta o seu peso?
 - a. Apóio totalmente, sem dor
 - b. Apóio, mas sinto dor
 - c. É impossível suportar o peso
3. Ao caminhar
 - a. Não tenho limites para caminhar
 - b. Caminho mais que 2 km
 - c. Caminho entre 1 e 2 km
 - d. Não consigo
4. Ao subir / descer escadas
 - a. Não tenho dificuldade
 - b. Sinto um pouco de dor ao descer
 - c. Sinto dor ao descer e ao subir
 - d. Não consigo
5. Ao agachar
 - a. Não tenho dificuldade
 - b. Sinto dor após agachamentos repetidos
 - c. Sinto dor a cada agachamento
 - d. Somente agacho com diminuição de meu peso (me apoiando)
 - e. Não consigo
6. Ao correr
 - a. Não tenho dificuldade
 - b. Sinto dor após correr mais do que 2 km
 - c. Sinto dor leve desde o começo
 - d. Sinto dor intensa
 - e. Não consigo
7. Ao pular/saltar
 - a. Não tenho dificuldade
 - b. Tenho um pouco de dificuldade
 - c. Sinto dor constante
 - d. Não consigo
8. Ao sentar com os joelhos flexionados/dobrados por período prolongado
 - a. Não tenho dificuldade
 - b. Sinto dor para me manter sentado após ter realizado exercícios
 - c. Sinto dor constante
 - d. A dor faz com que necessite estender (esticar) os joelhos de tempos em tempos
 - e. Não consigo
9. Dor
 - a. Nenhuma
 - b. Leve e ocasional
 - c. A dor atrapalha o sono
 - d. De vez em quando é intensa
 - e. Constante e intensa
10. Inchaço (edema)
 - a. Nenhum
 - b. Após esforço intenso
 - c. Após atividades diárias
 - d. Toda noite
 - e. Constante
11. Movimentos anormais (subluxação) e doloridos da rótula (patela)
 - a. Não ocorre
 - b. Ocorre ocasionalmente durante atividades esportivas
 - c. Ocorre ocasionalmente durante atividades diárias
 - d. Já tive pelo menos um deslocamento
 - e. Já tive mais que dois deslocamentos
12. Atrofia da coxa (tamanho da coxa)
 - a. Nenhuma alteração do tamanho da coxa
 - b. Leve alteração do tamanho da coxa
 - c. Severa alteração do tamanho da coxa
13. Sente dificuldade para flexionar/dobrar o joelho?
 - a. Nenhuma
 - b. Leve
 - c. Muita

ANEXO 3: Normas da Revista

INSTRUCTIONS TO AUTHORS

JOSPT® instructions to authors discuss how and where to submit manuscripts, including tools and resources for authors and reviewers, and requirements for the protection of human subjects and animals and the appropriate use of cadavers. These instructions also cover the categories of manuscripts JOSPT publishes and detail how papers should be prepared for submission and review. They outline additional required documents and describe other contributions, such as musculoskeletal imaging, letters to the Editor-in-Chief, and invited commentaries. JOSPT's editorial policies and a manuscript checklist conclude these instructions.

MANUSCRIPT SUBMISSION

All manuscripts must be submitted online at <http://mc.manuscriptcentral.com/JOSPT>, which either can be accessed directly or through the JOSPT website at www.jospt.org. Please direct questions about online submission to the JOSPT office at 1-877-766-3450.

General Requirements

All manuscripts must meet the following basic requirements to be eligible for review by JOSPT:

- Written in English
- Include a cover letter
- Present findings or data that have not been previously published either in print or electronic (online) format or widely disclosed in a form other than published abstracts of oral presentations at scientific conferences and meetings
- Undergoing exclusive review by JOSPT
- Address scientific, clinical, or professional issues relevant to musculoskeletal or sports-related physical therapy practice
- Written in accordance with the "Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals" by the International Committee of Medical Journal Editors, December 2013 (<http://www.icmje.org/> and http://www.icmje.org/urm_main.html)
- Formatted according to AMA style guidelines (*American Medical Association Manual of Style, 9th Edition*), except for the references, which should be numbered consecutively in alphabetical order.

Submissions that do not meet the above essential requirements will be returned to the author without review. In the peer-review process, JOSPT reviewers are unaware of the author's identity and affiliation. Associate editors are not blinded to author identity and vice versa.

Author/Reviewer Tools and Resources

Authors are required and reviewers invited to take advantage of the author and reviewer tools and resources section of the JOSPT website (www.jospt.org), which provides useful links related to writing and reviewing manuscripts. These materials were created to assist authors in ensuring that key methodological information relevant to the conduct of their study is included in the manuscript. This section specifically provides a link to the EQUATOR Network website (<http://www.equator-network.org>), an excellent resource designed to help authors report on health research that includes links to resources such as the CONSORT, PRISMA, STROBE, and STARD statements, among others.

Revised Manuscripts

When the editors suggest that a manuscript be revised and resubmitted, the same guidelines outlined for the preparation of the original manuscript apply. All resubmitted manuscripts must be accompanied by a cover letter. The cover letter must include a list of all revisions with regard to suggestions in the review materials provided by the editorial

office. Changes made to the text and tables must be highlighted in the manuscript.

Protection of Human Subjects

The name of the Institutional Review Board or Ethics Committee that approved the research protocol involving human subjects must be included on the title page and in the Methods section. The Methods section must also contain a statement that informed consent was obtained and that the rights of the subjects were protected.

It is mandatory that clinical trials initiated on or after January 1, 2013 be prospectively registered in a public trials registry. In these cases, authors should provide the name of the registry and the registration number on the title page. For clinical trials initiated prior to January 1, 2013, prospective clinical trial registration is desirable but not mandatory.

Case reports should include, when required by the appropriate Institutional Review Board or Ethics Committee, a statement that each subject was informed that data concerning the case would be submitted for publication or a statement indicating approval by the Board. In all cases, patient confidentiality must be protected.

Use of Animals

Manuscripts with experimental results in animals must include a statement on the title page and in the Methods section that an animal utilization study committee approved the study.

Use of Cadavers

When applicable, manuscripts with experimental results on cadavers must include a statement on the title page and in the Methods section that a relevant utilization study committee approved the study.

MANUSCRIPT CATEGORIES**Research Report**

A full-length report of an original clinical, basic, or translational research investigation that advances the clinical science of musculoskeletal and sports-related physi-

cal therapy. This category also includes systematic literature reviews with or without meta-analysis.

Authors submitting a randomized controlled trial must consult the CONSORT statement (revised in 2010) and its related extension for trials of nonpharmacological treatments, checklist, and flow diagram (<http://www.consort-statement.org/> and <http://www.consort-statement.org/consort-statement>). *JOSPT* further requires that a flow diagram illustrating the progress of patients throughout the trial be included as a figure in the manuscript. In addition, authors must include a copy of the completed CONSORT checklist appended to the manuscript, with the understanding that the checklist will not appear with any published paper.

Authors submitting manuscripts for observational studies (cohort, case-control, cross-sectional studies) should comply with the STROBE statement (<http://www.strobe-statement.org/index.php?id=strobe-home>) and should submit a completed STROBE checklist together with the manuscript. The checklist is used to facilitate the peer-review process but is not published with studies accepted for publication.

Large therapy or prevention studies that use a case series design should also be submitted as research reports and be submitted with an accompanying STROBE checklist.

Similarly, preparation of studies investigating the diagnostic accuracy of clinical tests will benefit from consulting the STARD statement, checklist, and flow diagram (<http://www.stard-statement.org>). *JOSPT* requires that a flow diagram illustrating the progress of patients throughout the study be included as a figure in the manuscript. Authors must include a copy of the completed STARD checklist appended to the manuscript, with the understanding that the checklist will not appear with any published paper.

Systematic reviews of the literature, with or without a meta-analysis, addressing a topic of interest and relevance to

musculoskeletal, sports, and manual physical therapists are also considered research reports. Accordingly, systematic literature reviews must have a structured abstract and include a Methods section detailing the search strategy, inclusion/exclusion criteria, evaluation of the quality of the articles, etc. The editor-in-chief must invite manuscripts submitted in this category; however, self-nominations for an invitation to submit a systematic literature review are welcome. Self-nominations, which must include a cover letter addressed to the editor-in-chief and a current curriculum vitae, should be sent electronically to jospt@jospt.org.

Authors submitting a systematic literature review of randomized controlled trials should consult the PRISMA statement and related checklist and flow diagram for quality reporting of systematic reviews and meta-analyses (<http://www.prisma-statement.org>). *JOSPT* requires that a flow diagram illustrating the progress of study selection and exclusion (as well as reasons for exclusion) be included as a figure in the manuscript. Authors must include a copy of the completed PRISMA checklist appended to the manuscript, with the understanding that the checklist will not appear with any published paper. Prospective registration of systematic reviews protocol information in a database such as PROSPERO (www.crd.york.ac.uk/PROSPERO/) is recommended but not required.

The above is not a full list of study designs and the authors are required to use the appropriate checklist for their study design as available on the EQUATOR Network website (<http://www.equator-network.org>).

Case Report

A detailed description of the management of a unique clinical case. Case reports must include the following 4 sections: Background, Case Description, Outcomes, and Discussion. The description of the case includes the relevant patient characteristics, examination/evaluation, diagno-

sis, and a description of the interventions that were provided. Manuscripts describing the management of a small group of similar patients are also considered in this category and should be formatted accordingly.

Authors submitting a case report or case series should consult the CARE case report guidelines (<http://www.care-statement.org/>). *JOSPT* requires that a copy of the completed CARE checklist is included as a supplemental file when submitting a manuscript of this type.

Resident's Case Problem

A report on the process and logic associated with differential diagnosis (ie, clinical decision making). The Background section includes general clinical or research information pertinent to the case. The Diagnosis section provides patient characteristics and history. It then details the examination and evaluation process leading to the working diagnosis and the rationale for that diagnosis, including a presentation of medical imaging studies and the results of other clinical tests. Interventions used to treat the patient's condition and the outcome of treatment may also be briefly described at the end of the Diagnosis section; however, the focus of the resident's case problem should be on the diagnostic process. The Discussion section offers a scholarly, critical, and referenced analysis of how the diagnosis guided the care of the patient.

Clinical Commentary

A scholarly paper containing opinion or perspectives having relevance to musculoskeletal and sports physical therapy. Clinical commentaries submitted for review require an abstract that is not structured. The editor-in-chief must invite clinical commentaries. Self-nominations for an invitation to submit a clinical commentary are welcome. Self-nominations, along with a cover letter addressed to the editor-in-chief and current curriculum vitae, should be sent electronically to jospt@jospt.org.

INSTRUCTIONS TO AUTHORS (CONTINUED)

Narrative Literature Review

Literature reviews on topics that are not conducive to a formal systematic review but are relevant to musculoskeletal and sports physical therapy may be considered for publication. The editor-in-chief must invite narrative literature reviews. Self-nominations, which must include a cover letter addressed to the editor-in-chief and current curriculum vitae, are welcome and should be sent electronically to jospt@jospt.org.

Brief Report

Suitable for high-quality, high-impact research reports that are less than 2000 words (excluding references) and have no more than a total of 4 tables or figures. The number of references should be 20 or less. Potential exists for additional supporting material (ie, tables, figures) to be included as appendices online if needed. This category of papers can be used for all types of research reports, including the description of a new instrument, technology, or methods relevant to musculoskeletal physical therapy practice or clinical research. Follow the instructions for research reports, using the additional information provided above to prepare the manuscript.

MANUSCRIPT PREPARATION

All manuscripts submitted to *JOSPT* should be double-spaced and have 2.54-cm (1-in) margins on all sides of the page. Pages should be consecutively numbered, starting with the title page. Pages should be continuously line numbered, with line numbers starting at 1 on the abstract. The font should be 12-point Arial, Times New Roman, or Courier. All measurements in the manuscript should be presented in SI units, except for those of angular measures, which should be presented in degrees rather than radians. The manuscript should be arranged as follows:

Title Page (separate page)

- Title of the manuscript
- Names of each author with their highest academic credential (ie, PhD), or most relevant professional designation

(eg, PT), or both (eg, PT, PhD). Limit credentials to these 2 items only

- Institution, city, state/country for each author
- Statement of the sources of grant support (if any)
- Statement of Institutional Review Board or Ethics Committee approval of the study protocol
- Name of the public trials registry and the registration number
- Corresponding author's name, address, and e-mail address
- Word count of the text portion of the manuscript

Anonymous Title Page (separate page)

- Title of the manuscript
- Statement of financial disclosure and conflict of interest (see item 6 of the Author Agreement and Publication Rights Form)
- Acknowledgements (on a separate page)

Abstract

- Structured Abstract: Research reports (including systematic literature reviews) and brief reports require an abstract containing a maximum of 250 words, divided into 6 sections with the following headings (in this order): Study Design, Background, Objectives, Methods, Results, Conclusion. The abstract for case reports should have 5 sections with the following headings: Study Design, Background, Case Description, Outcomes, and Discussion. The abstract for resident's case problems should have 4 sections with the following headings: Study Design, Background, Diagnosis, and Discussion.
- Unstructured Abstract: Clinical commentaries and narrative literature reviews require an abstract (called synopsis) that is not structured and that contains a maximum of 250 words.
- All abstracts should include, when appropriate, a line item called "Level of Evidence," which indicates the study type and level of evidence, according to the classification system listed at the

Oxford Centre for Evidence-Based Medicine website (<http://www.cebm.net>).

This final line in the abstract should be in the following format example: "Level of Evidence: Therapy, level 2a." When the study does not fit any of the study type and level of evidence descriptors included in the above classification system, this line may be omitted.

- A list of suggested study design names and the Oxford Centre for Evidence-Based Medicine levels of evidence table are provided for reference in the Authors section of the *JOSPT* website.
- All abstracts should end with a Key Words section, containing 3 to 5 key words that do not appear in the manuscript title.

Text

- Research reports, systematic literature reviews, and brief reports require the body of the manuscript to be divided into 5 sections: Introduction, Methods, Results, Discussion, and Conclusion.
- Case reports require the body of the manuscript to be divided into 4 sections: Background, Case Description, Outcomes, and Discussion.
- Resident's case problems require the body of the manuscript to be divided into 3 sections: Background, Diagnosis, and Discussion.
- Clinical commentaries and narrative literature reviews do not have specific mandatory subdivisions or sections.

For all manuscripts, the text should be less than 4000 words and be supplemented by a reasonable number of figures and tables.

Key Points

The brief Key Points section of the manuscript (needed for research reports only, including systematic literature reviews) should be provided at the end of the text, prior to the references. These points should be written in a user-friendly language, consist of brief sentences, and summarize the most important information related to the findings, implications,

and caution directly resulting from the work. These 3 subheadings should be used:

- Findings: One or 2 statements on what the study adds to current knowledge.
- Implications: A statement on how the results impact clinical practice or research on this topic.
- Caution: A statement on the most important limitations of the study, especially external validity (what may prevent wide utilization of the results).

References

- References should be numbered consecutively in alphabetical order, according to author last name and initials, title, and year. Where the first-author names are identical, references with 1 author precede those with multiple authors. Where all the author names are identical, the title is the next ordering component, followed by the year.
- All references in the References section must be cited in the text.
- References must be cited in the text by using the reference number in superscript at the end of the sentence or the referenced portion of the sentence. The reference goes after the author's name when the author's name is listed (eg, Davies¹). If there are only 2 authors in the reference, then the text should include both authors (eg, Davies and Ellenbecker¹). If the reference has more than 2 authors, the text should include "et al" after the first author's name (eg, Davies et al¹).
- In the Reference section, when a reference has 7 or more authors, list the first 3 authors, followed by "et al."
- References must include only material that is retrievable through standard literature searches. References to papers accepted but not published or published ahead of print should be designated "in press" or use the PubMed/MEDLINE [Epub ahead of print] status until an updated citation is available. Doctoral and master's theses are considered published material. Information from manuscripts not yet accepted for publication and personal communications will not

be accepted. The use of abstracts and proceedings should be avoided unless they are very recent and the sole source of the information.

- Abbreviations for the journals in references must conform to those of the National Library of Medicine in Index Medicus (<http://www.ncbi.nlm.nih.gov/journals>).
- References that have CrossRef Digital Object Identifiers (doi) should include them at the end of the citation.
- References must be verified by the author(s) against the original documents.

Reference style and punctuation should conform to the examples that follow:

Journals

Wilson T. The measurement of patellar alignment in patellofemoral pain syndrome: are we confusing assumptions with evidence? *J Orthop Sports Phys Ther.* 2007;37:330-341. <http://dx.doi.org/10.2519/jospt.2007.2281>

Books

Portney LG, Watkins MP. *Foundations of Clinical Research: Applications to Practice.* 3rd ed. Upper Saddle River, NJ: Prentice Hall Health; 2009.

Organization as Author and Publisher

US Food and Drug Administration. Guidance for industry: patient-reported outcome measures: use in medical product development to support labeling claims. Rockville, MD: FDA; 2006.

Chapter in a Book

Jones MA, Rivett DA. Introduction to clinical reasoning. In: Jones MA, Rivett DA, eds. *Clinical Reasoning for Manual Therapists.* Edinburgh, UK: Butterworth-Heinemann; 2004:3-24.

Master's or Doctoral Thesis

Langshaw M. *Cervical Spine Mobilisation: The Effect of Experience and Subject on Dose* [thesis]. NSW, Australia: The University of Sydney; 2001.

Published Abstract of a Paper Presented at a Conference

Chen YJ, Powers CM. The dynamic Q-angle: a comparison of persons with and without patellofemoral pain [abstract].

Proceedings of the North American Congress on Biomechanics. Ann Arbor, MI: 2008.

Universal Resource Locator (URL)

NFHS Associations. 2007-2008 National Federation of State High School Associations Participation Survey. Available at: <http://www.nfhs.org>. Accessed May 17, 2010.

Paper Presented at a Symposium

Nelson-Wong E, Gregory DE, Winter DA, Callaghan JP. Postural control strategies during prolonged standing: is there a relationship with low back discomfort? American Society of Biomechanics Annual Conference. Palo Alto, CA: American Society of Biomechanics; 2007.

Tables

- Each table must be self-contained and provide standalone information independent of the text.
- See *AMA Manual of Style*, section 2.13, to organize and format tables.
- Table titles should list the table number in uppercase bold (eg, "TABLE 1"), followed by a period, then the title of the table in sentence case.
- Abbreviations used in each table must be spelled out below the table.
- Footnotes must be listed below the table, after the abbreviations, in order of occurrence in the table (left to right, row to row). According to AMA style, footnotes are cited with the following superscript symbols (in this order): *, †, ‡, §, ||, ¶, #, **, ††, ‡‡. Where these symbols are unavailable, superscript numbers may be used.
- All tables must be referred to somewhere in the text.
- All tables go after the reference list.

Figures

- Figure captions should list the figure number in uppercase bold (eg, "FIGURE 1") followed by a period, and continue with the text of the caption in sentence case.
- All abbreviations appearing in the figures should be defined in the caption

INSTRUCTIONS TO AUTHORS (CONTINUED)

for each respective figure, and abbreviations appearing only in the figure caption must be defined at first use.

- Digital figures must be at least 350 dpi (dots per inch).
- Charts and graphs generated from spreadsheet programs must accompany, or allow access to, the data
- Photographs must be in JPEG file format (JPG) and graphic art in GIF file format and at a resolution of at least 350 dpi.
- All figures must be referred to in the text.
- Each view (eg, A, B, C) within the figure must be defined in the figure caption.
- Color figures and graphics are welcome.
- All figures go after the tables at the end of the manuscript.

Videos

Authors may wish to consider including supplemental videos to be published online with their manuscript. These videos can describe intervention or examination techniques as well as surgical procedures or other material pertinent to the manuscript. Intent to include videos may be mentioned in the cover letter with the initial manuscript submission or may be discussed with the editor-in-chief once the manuscript is accepted. Videos should be:

- MPEG-1, MPEG-2, or AVI files.
- No longer than 2.5 minutes.
- Introduced with a title screen and include audio narration.
- There is no limit on the number of videos that may be submitted.

ADDITIONAL REQUIRED DOCUMENTS

For submissions to qualify for review, the following documents must either be e-mailed (manuscripts@jospt.org), mailed (JOSPT, 1033 N Fairfax St, Ste 304, Alexandria, VA 22314-1540), or faxed (1-703-891-9065) to the JOSPT office.

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This document must have original sig-

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Photograph/Video Release Statement

Signed photograph/video release forms should accompany photographs/videos of patients and subjects. A photograph/video release statement should contain the following: (1) manuscript title; (2) names of all authors; (3) statement placed below the manuscript title and author names as follows: "I hereby grant to the *Journal of Orthopaedic & Sports Physical Therapy* the royalty-free right to publish photographs and/or videos of me for the stated journal and the above manuscript in which I appear as subject, patient, or model, and for the stated *Journal's* website (www.jospt.org). I understand that any figure in which I appear may be modified."; and (4) the original signature and date signed from each subject who appears in the figures. This original signed statement must be submitted to the JOSPT office with the manuscript.

Patient/Author Release Statement

A release form should accompany all Musculoskeletal Imaging cases, Case Reports, and Resident's Case Problems. This release must be signed either by the patient/subject or by the submitting author, accompanied by a proxy declaration by the author(s) that all necessary efforts have been made to ensure that Standards for Privacy of Individually Identifiable Health Information have been upheld, and that the author accepts any and all liability for any failure to uphold the necessary Standards for Privacy of Individually Identifiable Health Information in the final version of the manuscript. The release statement should contain the following: (1) manuscript title; (2) names of all authors; (3) a statement from the submitting author, placed below

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OTHER CONTRIBUTIONS

Musculoskeletal Imaging

This feature focuses on the use and interpretation of medical imaging related to a case scenario relevant to musculoskeletal or sports physical therapy practice. In most instances, these cases will emphasize how information from imaging can affect physical therapy management of the patient. In some instances, however, this feature may be used to share information on unusual medical conditions, or to simply illustrate commonly used imaging techniques and their interpretation. Contributions should include no more than 3 authors, 250 words, 3 figures, and 3 references (if any). Submissions, including text and images, must be submitted online at <http://mc.manuscriptcentral.com/jospt>, which can be accessed either directly or through the JOSPT website at www.jospt.org. Please direct questions about online submission to the JOSPT office at 1-877-766-3450. See the Figures section of the

instructions to authors for technical specifications for the figures.

Letter to the Editor-in-Chief

A letter related to professional issues or articles published in the *Journal*. Letters will be reviewed and selected for publication by the editor-in-chief based on the relevance, importance, appropriateness, and timeliness of the topic. Letters to the editor-in-chief are copy edited and the correspondent is not typically sent a version to approve. Letters to the editor-in-chief should include a summary statement of any conflict of interest, including financial support related to the issue addressed. Letters should be sent electronically to jospt@jospt.org. Authors of the relevant manuscript are given the opportunity to respond to the content of the letter.

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An expert's point of view concerning an article published in the *Journal*. Commentaries are invited by the editor-in-chief and immediately follow the article discussed. Authors of the manuscript under commentary are given the opportunity to respond to the expert's point of view.

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