UNIVERSIDADE FEDERAL DE SANTA CATARINA – UFSC
DEPARTAMENTO DE CIÊNCIAS E SAÚDE – CAMPUS ARARANGUÁ
GRADUAÇÃO EM FISIOTERAPIA

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CONFIABILIDADE INTRA E INTERAVALIADOR PARA MEDIDAS ANGULARES DE MEMBRO INFERIOR ATRAVÉS DA FOTOGRAMETRIA

ARARANGUÁ
2021

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Artigo apresentado ao Curso de Graduação em Fisioterapia, da Universidade Federal de Santa Catarina, como requisito parcial da disciplina de Trabalho de Conclusão de Curso II

Orientador: Prof. Dr. Alessandro Haupenthal.

ARARANGUÁ

2021

AGRADECIMENTOS

Agradeço em primeiro lugar a minha família, em especial aos meus pais, Veranice e Laércio, e ao meu irmão Henrique, que mesmo de longe, me deram todo apoio, possibilitando que eu realizasse esse sonho. Obrigado por me incentivarem, sem vocês nada seria possível.

Ao meu namorado, Deividi, que esteve comigo desde o início da faculdade, me incentivando e me apoiando em todos momentos difíceis. Obrigada por todo tempo dedicado a mim, pela imensa paciência, companheirismo e amor.

Agradeço ao meu orientador, professor Alessandro, que me acolheu de braços abertos, me conduzindo pelo caminho da pesquisa com muita paciência e maestria. Obrigada por todos os momentos que enriqueceram o meu conhecimento profissional e pessoal.

Agradeço a todos amigos, colegas e professores que fizeram parte dessa trajetória. Em especial, gostaria de agradecer a Daniela, por toda sua ajuda quando iniciei as primeiras pesquisas. Obrigada pelas palavras carinhosas e motivadoras, por sua disposição em cada coleta, e por estar comigo em todos momentos.

Por fim, agradeço a todos que de certa forma contribuíram para minha formação acadêmica. Meu muito obrigada por tudo!

Confiabilidade intra e interavaliador para medidas angulares de membro inferior através da fotogrametria

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RESUMO

Objetivo: Verificar a confiabilidade intra e interavaliador para medidas angulares de membro inferior através da fotogrametria.

Desenho: Estudo observacional transversal randomizado com desenho de teste reteste e intervalo de dois dias em que os pacientes realizaram os seguintes testes de flexibilidade: iliopsoas, isquiotibial quadríceps e gastrocnêmio.

Local: Laboratório de envelhecimento recursos e reumatologia.

Participantes: Trinta pessoas assintomáticas com idade entre 18 e 39 anos.

Principais Medidas de Resultados: A flexibilidade de iliopsoas, isquiotibiais, quadríceps e gastrocnêmio foram analisados através da fotogrametria. Para análise da confiabilidade intra e interavaliador foi utilizado o coeficiente de correlação intraclasse. O erro padrão de medição (SEM) e a diferença mínima detectável (MDC) também foram calculados.

Resultado: A fotogrametria apresentou índices de confiabilidade intra-avaliador excelentes para os músculos iliopsoas (ICC=0.96; SEM=1.4 graus; MDC=3.8), isquiotibiais (ICC=0.99; SEM=1.1 graus, MDC=3.1), quadríceps (ICC=0.99; SEM=0.8 graus; MDC=2.3) e gastrocnêmio (ICC=0.98; SEM=0.9 graus; MDC=2.5). A análise interavaliador, apresentou excelente confiabilidade para os músculos iliopsoas (ICC=0.92; SEM=1.7 graus; MDC=4.6) e gastrocnêmio (ICC=0.91; SEM=3.0 graus; MDC=5.8), e boa confiabilidade para o músculo isquiotibiais (ICC=0.90; SEM=2.8 graus; MDC=7.9) e quadríceps (ICC=0.85; SEM=2.1 graus; MDC=8.3).

Conclusão: A fotogrametria é um instrumento confiável para avaliação e reavaliação das medidas angulares dos membros inferiores, inclusive quando realizada por diferentes avaliadores.

Palavras-chave: Amplitude de Movimento Articular. Flexibilidade. Reprodutibilidade dos Testes. Variações Dependentes do Observador.

INTRODUÇÃO

Para identificar as limitações articulares durante uma avaliação física, são utilizados instrumentos que forneçam dados sobre a amplitude de movimento articular (ADM) (FIESELER *et al.*, 2015a, b). Os dados de ADM auxiliam o profissional a acompanhar a evolução do paciente e quantificar a eficácia do tratamento proposto durante a reabilitação (AMORIM *et al.*, 2014). Atualmente, o instrumento mais utilizado na prática clínica para avaliar a ADM é o goniômetro universal (GOUVEIA *et al.*, 2014).

No entanto, as medidas angulares realizadas com o goniômetro universal apresentam baixa confiabilidade (WAKEFIELD *et al.*, 2015) atribuída ao manuseio e uniformização das medidas (LEA, RD; GERHARDT, 1985). Outros instrumentos foram surgindo a fim de facilitar o processo de avaliação da ADM. Dentre estes instrumentos, destaca-se a fotogrametria (COENEN *et al.*, 2013; CRASTO *et al.*, 2015), a qual fornece informações sobre alterações sutis nas medidas angulares por meio de gravação, medição e interpretação das imagens de objetos físicos ou de ambientes (ICN *et al.*, 2007). Este processo facilita a quantificação de variáveis morfológicas, dificilmente mensuradas pela observação visual ou outro instrumento (DUARTE *et al.*, 2014). Apesar de constantemente utilizada para avaliações posturais (CANDOTTI *et al.*, 2019) são escassos estudos que abordam a reprodutibilidade da fotogrametria em medidas angulares de membros inferiores.

A partir da importância de ter instrumentos para avaliação que sejam de fácil manuseio, como a fotogrametria, e que tenham confiabilidade e reprodutibilidade em relação ao que se propõe avaliar (KOO; LI, 2016), o nosso objetivo foi verificar a confiabilidade intra e interavaliador da fotogrametria na avaliação da flexibilidade de membros inferiores (MMII). Espera-se que este instrumento apresente confiabilidade suficiente (acima de 0.75) (KOO; LI, 2016) para respaldar seu uso na prática clínica.

MÉTODOS

Desenho do estudo

Trata-se de um estudo observacional transversal randomizado com desenho de teste reteste e intervalo de dois dias. A variável de interesse foi o ângulo articular, medido em graus, durante o teste de amplitude de movimento para a musculatura analisada a partir da fotogrametria. Os músculos avaliados foram o iliopsoas, isquiotibiais, quadríceps e gastrocnêmio. Foram utilizadas as diretrizes para relatórios de estudos de confiabilidade e concordância (GRRAS) (KOTTNER *et al.*, 2011) como base para relatar este estudo de confiabilidade.

Participantes

O tamanho da amostra foi baseado no artigo de KOO e LI, (2016), o qual estima que em estudos de confiabilidade, a fim de calcular a estimativa de erro aleatório, uma amostra de 30 participantes heterogêneos é suficiente. O método de amostragem foi não probabilístico, por conveniência, na qual os participantes se voluntariaram através de convites informais e publicação online. O recrutamento e a coleta de dados dos participantes ocorreram entre novembro e dezembro de 2018. Este estudo foi conduzido nas dependências da Universidade Federal de Santa Catarina (UFSC), aprovada pelo Comitê de Ética em Pesquisa da Universidade Federal de Santa Catarina, sob parecer 1.771.454. Todos participantes leram e assinaram o Termo de Consentimento Livre e Esclarecido.

Como critério de inclusão todos os participantes deveriam ser saudáveis, de ambos os sexos, possuir idade entre 18 e 39 anos (LIMA *et al.*, 2006; PALMER, 2019). Como exclusão, seriam excluídos aqueles que apresentaram alguns dos critérios a seguir no membro inferior direito: dor ou desconforto persistente nos últimos três meses ou no dia da avaliação (CEJUDO *et al.*, 2015), histórico de lesão nos últimos 6 meses (DONTI *et al.*, 2020) ou intervenção cirúrgica e não comparecer no segundo dia de avaliação.

Avaliadores

Para verificar a confiabilidade intra e interexaminador, três examinadores sem experiência com a fotogrametria e com o manuseio do *software* SAPO realizaram a avaliação dos participantes. Dois avaliadores eram estudantes do curso de fisioterapia, e o terceiro avaliador era fisioterapeuta. Todos foram instruídos previamente de como realizar o posicionamento do participante, procedimentos de avaliação, critérios de interrupção do teste, e como utilizar o *software* SAPO.

Randomização e cegamento

A ordem de avaliação dos três examinadores e das medidas foi randomizada por um pesquisador externo (DE) e alocadas em envelopes pardos selados e numerados sequencialmente, os quais só foram abertos no primeiro dia de avaliação na presença do participante. A ordem randomizada de medidas e avaliador foi a mesma por participante para os dois dias de coleta. Após a coleta, os dados foram tabulados, codificados em cores (CN) e enviados à um quarto avaliador para realizar análise estatística (AH). Posteriormente, os dados foram decodificados pelo avaliador principal (CN), caracterizando o cegamento da etapa de análise de dados.

Procedimento de coleta de dados

Após a seleção da amostra, os participantes compareceram ao laboratório dois dias, com intervalo de 48 horas para avaliação das medidas (Figura 1). Todos os participantes estavam vestindo calção de academia, a fim de realizar a palpação dos pontos anatômicos e não limitar o movimento. Ao chegarem, foram posicionados em decúbito dorsal para posicionar as esferas de isopor de 25mm nos seguintes pontos anatômicos: trocanter maior do fêmur, epicôndilo lateral do fêmur, cabeça da fíbula, maléolo lateral e falange do quinto dedo. Após demarcar os pontos anatômicos, permaneceram 15 minutos em repouso antes da análise. Para garantir precisão e consistência, o mesmo avaliador colocou os marcadores que permaneceram durante todas as avaliações. O membro inferior direito foi avaliado para todos os participantes.

Para coletar as imagens de cada grupo muscular, a câmera Canon PowerShot Sx530 HS, Canon Indústria de Manaus Ltda.; Brazil, foi posicionada sobre um tripé a uma altura de 1,05 m do solo e distância de 2,08 m do participante nas medidas de iliopsoas, isquiotibiais e quadríceps. Para a medida de gastrocnêmio o tripé foi posicionado a uma altura de 0,6 m do solo e 1,5 m de distância do participante. Três avaliadores realizaram todas as análises, respeitando um intervalo de 15 minutos entre cada avaliador para a realização das medidas. Todas avaliações ocorreram no mesmo horário do dia e com a temperatura do laboratório controlada entre 19 e 23°. Após a coleta, as imagens foram transferidas para um computador e analisadas através do *software* Sapo v. 0.69.

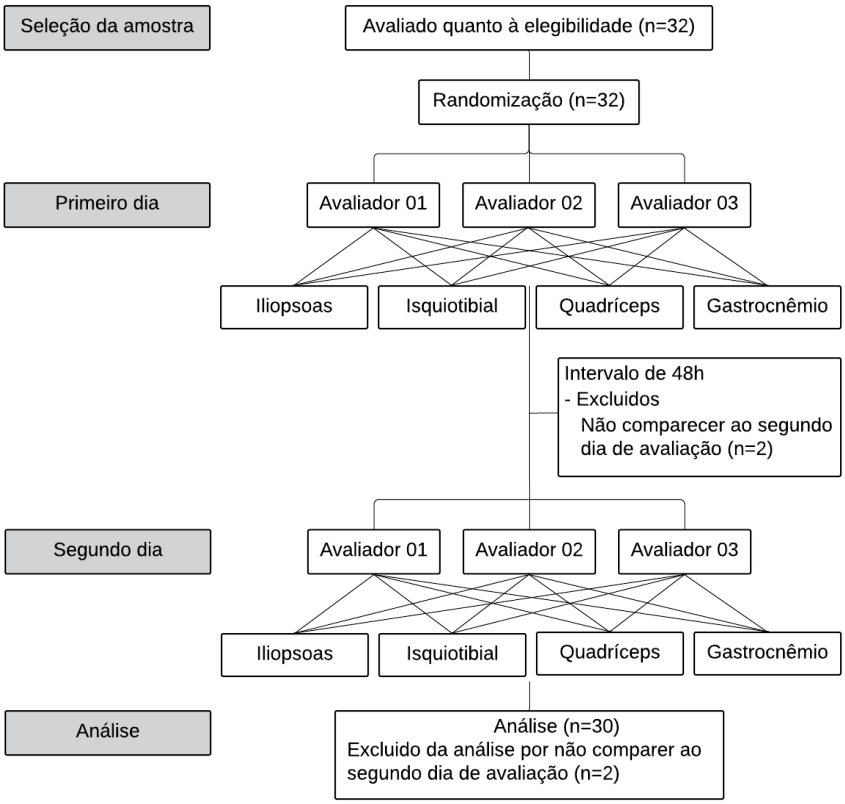

Figura 01: Fluxograma da seleção e randomização dos participantes.

Avaliação da amplitude de movimento

Para verificar a ADM, os participantes foram posicionados de acordo com o grupo muscular o qual seria avaliado. O posicionamento e delineamento dos pontos anatômicos para realizar a avaliação dos músculos isquiotibiais, quadríceps e gastrocnêmio foi feito conforme preconizado por WITVROUW *et al.* (2003) e para iliopsoas conforme preconizado por DEZAN; SARRAF; RODACKI, (2004). A avaliação do iliopsoas (Figura 02 A) era interrompida quando se observava qualquer tipo de compensação do membro contralateral. Na avaliação dos isquiotibiais (Figura 2 B) a medida era interrompida caso o participante apresentasse flexão de joelho, rotação interna ou externa do fêmur ou elevação do membro contralateral. Na avaliação do quadríceps (Figura 2 C), a medida era interrompida se o participante apresentasse aumento da lordose lombar, anteversão pélvica ou extensão de quadril. E para avaliação da flexibilidade de gastrocnêmico (Figura 2 D) a medida era interrompida se o participante apresentasse flexão de joelhos e/ou retirasse o calcanhar do chão.

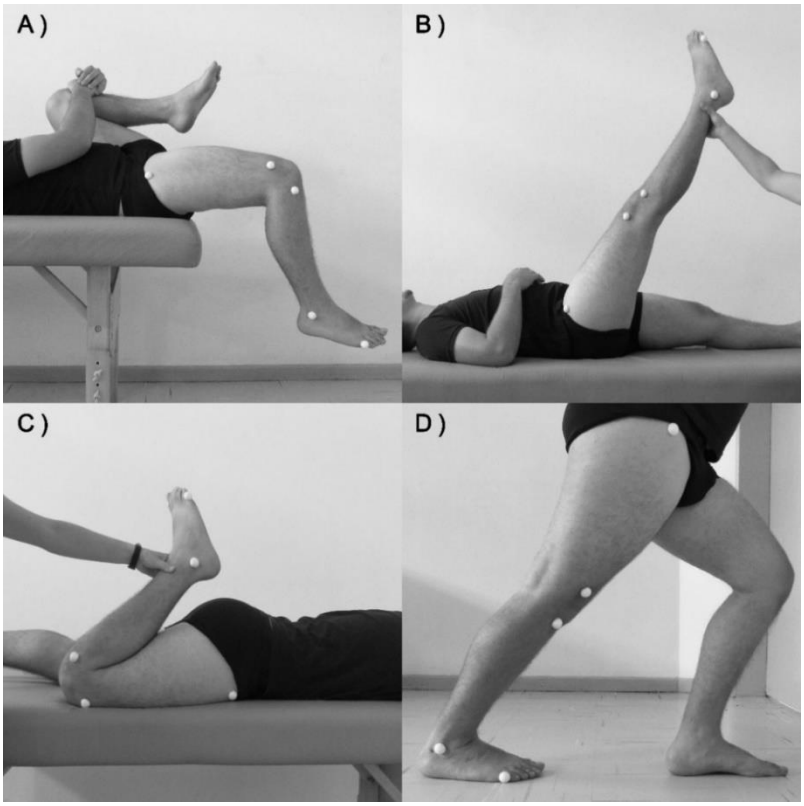

Figura 02: Representação dos ângulos medidos por fotogrametria e do método de avaliação da flexibilidade para: A) Iliopsoas, B) Isquiotibial, C) Quadríceps, D) Gastrocnêmio.

Análise estatística

A normalidade dos dados foi verificada através do teste de Shapiro-Wilk. Para análise da confiabilidade intra-avaliador foi usado o ICC a partir de modelo misto (3,1) do tipo acordo absoluto. No ICC inter-avaliador foi usado o modelo misto com k=3 (3,3) e do tipo consistência. Ambos ICCs com intervalo de confiança de 95% (KOO; LI, 2016). No qual um ICC < 0,50 representa baixa confiabilidade, 0,50 a < 0,75 confiabilidade moderada, 0,75 a 0,90 boa confiabilidade e > 0,90 excelente confiabilidade (PORTNEY; WATKINS, 2000).

Para o cálculo do erro padrão de medição será utilizada a fórmula (1) (WEIR, 2005): SEM = SD ($\sqrt{1 - ICC}$). Nesta fórmula o *Standard Deviation* (SD) será calculado a partir da equação (2) (De VET, 2011): SD = $\sqrt{SD_1^2 + SD_2^2 + SD_3^2}/3$. ICC da análise intra-avaliador, o limite superior do intervalo de confiança será calculado multiplicando o valor de SEm por 1,96 (DAVI *et al.*, 2014). A diferença mínima detectável foi calculada através da fórmula (3) (WEIR, 2005): MDC = SEM x 1.96 x $\sqrt{2}$. Além disso, foram realizados gráficos de Bland-Altman para verificar a concordância dos dados (J.M.BLAND; D.G.ALTMAN, 1986).

RESULTADO

O estudo incluiu 30 participantes saudáveis, sendo 15 do sexo feminino e 15 do sexo masculino, com idade média de 22±3 anos. Três avaliadores com idade média de 22±2 anos participaram da análise das medidas.

A análise dos valores de coeficiente de correlação intraclasse (ICC) para as medidas intra-avaliador demostraram excelente confiabilidade para todos testes de flexibilidade (ICC= 0.96 – 0.99), como podemos observar na Tabela 01. Quanto ao nível de confiabilidade interavaliador foi encontrado um ICC de excelente confiabilidade para iliopsoas (ICC=0,942) e gastrocnêmio (ICC= 0,912), e uma boa confiabilidade para isquiotibiais (ICC=0,90) e quadríceps (ICC=0,851). (Tabela 02).

Tabela 01: Confiabilidade intra-avaliador para a medida de flexibilidade muscular em graus no dia 1 e dia 2 em participantes saudáveis (n=30).

Variável	ICC	CI 95%	Dia 01	Dia 02	SEM	MDC
Iliopsoas	0.96	0.91 - 0.98	1.9±6.6	2.1±6.9	1.4	3.8
Isquiotibiais	0.99	0.99 - 0.99	70.7±11.1	70.7±11.3	1.1	3.1
Quadríceps	0.99	0.99 - 0.99	52±8.1	52.3±8.1	0.8	2.3
Gastrocnêmio	0.98	0.97 - 0.99	83.2±6.3	83.5±6.5	0.9	2.5

ICC: Coeficiente de correlação intraclasse; SEM: erro padrão de medição; MDC: diferença mínima detectável.

Tabela 02: Confiabilidade interavaliador para a medida de flexibilidade muscular em graus em participantes saudáveis (n=30).

Variável	ICC	CI 95%	Avaliador 01	Avaliador 02	Avaliador 03	SEM	MDC
Iliopsoas	0.942	0.89 - 0.97	1.8±6.1	2.3±7.9	1.4±6.6	1.7	4.6
Isquiotibiais	0.90	0.81 - 0.94	69.2±9.2	66.4±8.6	68.3±9.6	2.8	7.9
Quadríceps	0.851	0.48 – 0.94	52.4±7.6	45.8±7.9	46.7±7.7	3.0	8.3
Gastrocnêmio	0.912	0.83 - 0.95	82.6±6.3	82.3±7.7	82.3±8.4	2.1	5.8

Fonte: autora.

Os gráficos de Bland-Altman (Figura 3) mostraram que os limites de concordância para intra-avaliador foi de 0,1 (+8,5 e -8,3), 0,01 (+8,4 e -8,4), -0,06 (+4,5 e -4,6) e 1,54 (+10,9 e -7,9) para as medidas em graus de iliopsoas, isquiotibial, quadríceps e gastrocnêmio, respectivamente.

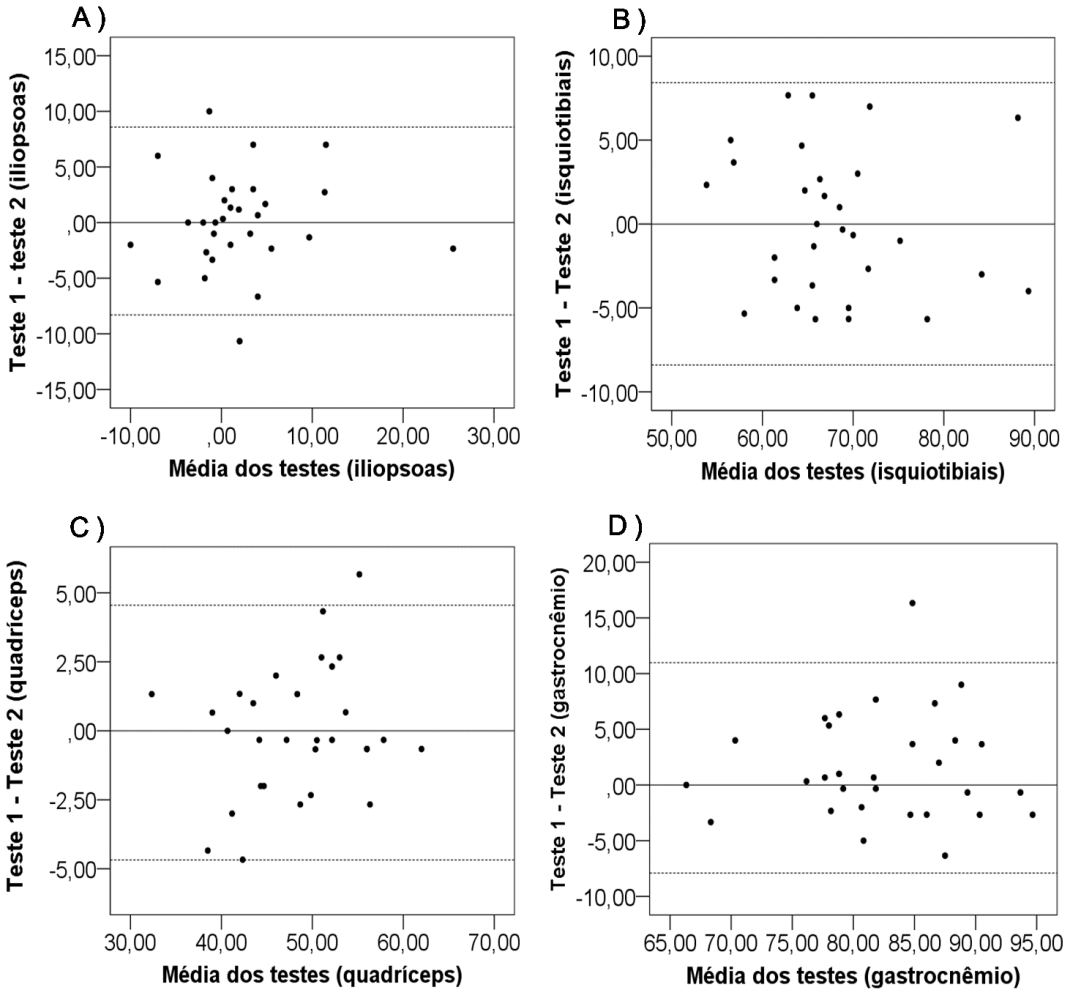

Figura 03: Gráfico de Bland-Altman durante análise intra-avaliador para o grupo muscular. A) Iliopsoas. B) Isquiotibiais. C) Quadríceps. D) Gastrocnêmio. Os limites foram +/- 2SD

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DISCUSSÃO

O objetivo deste estudo foi verificar se a fotogrametria na avaliação de medidas angulares do membro inferior apresenta confiabilidade intra e interavaliador suficiente para respaldar seu uso na prática clínica. Nossos resultados demonstraram que a fotogrametria é uma ferramenta confiável por apresentar ICC próximo a 1 e pequenos erros de medição.

Durante a análise intra-avaliador, a fotogrametria apresentou valores de ICC acima de 0.96 e erro menor que 1.4 graus para todos músculos analisados, representando

uma excelente confiabilidade. Podemos observar que não houve variação dos dados por um mesmo avaliador em duas tentativas. Sugerindo que, quando padronizado o local de aplicação das esferas de isopor, é possível reproduzir valores semelhantes em dias diferentes.

A análise interavaliador apresentou valores de ICC acima de 0.85, entre duas medidas com confiabilidade excelente, e erro menor que 3 graus. SARRO; MOMBRINI; TONOLE (2018) preconiza a utilização de avaliadores experientes para uma boa confiabilidade. Mas, optamos por avaliadores que não possuíam experiência com a técnica e com o manuseio do *software* SAPO. Os resultados indicam que quando tomados os cuidados de posicionamento do paciente e da câmera, repouso prévio a coleta, boa definição dos critérios de interrupção do teste e treinamento adequado, mesmo avaliadores inexperientes podem reproduzir medições angulares de forma confiável através da fotogrametria.

O MDC deve ser compreendido como um limiar da ferramenta de medição, na qual valores abaixo do MDC estão relacionados ao erro de medição do avaliador (SARRO; MOMBRINI; TONOLE, 2018). Ao utilizarmos a fotogrametria na avaliação do iliopsoas, é necessário um valor acima de 3.8 graus se analisadas pelo mesmo avaliador e 4.6 graus se analisadas por avaliadores diferentes para afirmar um ganho de ADM. Se verificarmos o músculo isquiotibial, é necessário um valor acima de 3.1 graus para o mesmo avaliador e 7.9 para diferentes avaliadores. Para quadríceps valores acima de 2.3 graus para o mesmo avaliador e 8.3 graus para avaliadores diferentes devem ser considerados. E quando analisado o músculo gastrocnêmio é fundamental levar em consideração um valor acima de 2.5 graus para um avaliador, e 5.8 graus para diferentes avaliadores. Propondo que valores iguais ou superiores a essas medidas são necessárias para ultrapassar o limiar do erro de medição.

A fotogrametria possui pontos anatômicos definidos durante todo arco de movimento, não perdendo a especificidade do local demarcado durante a análise no *software.* Diferente do goniômetro universal que, devido à instabilidade dos dois braços e eixo durante o movimento, e pela ambiguidade dependente da estimativa visual durante o posicionamento horizontal do braço longo na linha média do tronco (LEA, RD; GERHARDT, 1985) pode acabar apresentando baixa confiabilidade (WAKEFIELD *et al.*, 2015).

Outras ferramentas, como dispositivo de Charles (CHARLES, 2016) e Goniômetro Digital Halo (HANCOCK; HEPWORTH; WEMBRIDGE, 2018), também se propõe a avaliar a flexibilidade. Ambas as técnicas demonstram um baixo erro de medição e uma excelente confiabilidade. No entanto, métodos baseados em equipamentos especiais possuem alto custo para aquisição e manutenção, além de serem específicos a uma função, o que dificulta seu uso em clínicas. Em razão disso, a fotogrametria demostra uma vantagem em sua aquisição por ter capacidade de avaliar todos músculos de membro inferior.

A fotogrametria surgiu para se aliar a dispositivos e testes especiais. Demonstrando ser um recurso de baixo custo capaz de fornecer dados confiáveis na avaliação da flexibilidade de membros inferiores. Uma outra vantagem desta técnica é o feedback para o paciente, após uma cirurgia ou fratura, quando a propriocepção está alterada, o paciente é capaz de observar o seu membro em foto quando ganhou 5 graus, podendo ser um fator de incentivo para a continuidade do trabalho de mobilidade e ganho de ADM. Porque 5 ou 10 graus são ganhos importantes, mas difícil de ser percebido pelo paciente. Dessa forma, os valores encontrados nesse estudo são importantes para o uso da fotogrametria no ambiente clínico. Uma vez que proporciona feedback visual ao paciente, é de baixo custo, e boa reprodutibilidade. Proporciona precisão em suas medidas, constituindo uma ferramenta útil de análise para a prática clínica.

Alguns fatores têm a capacidade de alterar a medição e devem ser controlados como a força aplicada, duração da força e temperatura do tecido (SAPEGA *et al.*, 1981). Uma limitação do nosso estudo foi a força aplicada pelo avaliador durante a movimentação do membro inferior do participante. Embora todos os esforços tenham sido feitos para garantir o limite informado pelo participante a cada avaliação, não é possível descartar alguma alteração no ângulo articular durante a medição causada pela força imposta por cada avaliador.

CONCLUSÃO

A fotogrametria é um instrumento de avaliação confiável para a análise das medidas angulares de membro inferior. Independentemente de ser analisada pelo mesmo examinador ou por examinadores diferentes.

DECLARAÇÃO DE INTERESSE

Nenhum declarado.

APROVAÇÃO ÉTICA

Essa pesquisa foi aprovada pelo Comitê de Ética em Pesquisa da Universidade Federal de Santa Catarina, sob parecer 1.771.454. Todos participantes leram e assinaram o Termo de Consentimento Livre e Esclarecido.

FINANCIAMENTO

Esse trabalho foi apoiado pelo Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

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APÊNDICE A – TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

UNIVERSIDADE FEDERAL DE SANTA CATARINA – UFSC
CENTRO DE CIÊNCIAS, TECNOLOGIAS E SAÚDE
CURSO DE FISIOTERAPIA

Laboratório de Envelhecimento, Recursos e Reumatologia

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Você _____ está sendo convidado a participar como voluntário da pesquisa intitulada "Confiabilidade intra e interavaliador para medidas angulares de membro inferior através da fotogrametria". Esta pesquisa está relacionada ao Trabalho de Conclusão de Curso (TCC) da acadêmica Carolina Holz Nonnenmacher, orientada pelo Prof. Dr. Alessandro Haupenthal no curso de Fisioterapia da Universidade Federal de Santa Catarina (UFSC). Este estudo tem como objetivo verificar a confiabilidade intra e interavaliador da fotogrametria na avaliação de medidas angulares de membro inferior. O resultado e o conhecimento dele gerado contribuirá para o conhecimento de uma nova ferramenta para a análise da amplitude de movimento (ADM). Para a análise será previamente combinado data e horário, no qual os procedimentos serão previamente informados e realizados por pessoal qualificado.

Nessa pesquisa você participará da avaliação de quatro musculaturas de membro inferior, sendo elas: iliopsoas, isquiotibiais, quadríceps e gastrocnêmio. As avaliações acontecerão em dois dias distintos, com intervalo de 48h, e por três examinadores. As avaliações iniciam com a coleta de informações (idade, sexo, modalidade esportiva). Depois desta etapa, será realizado as medições de ADM, sendo disposto na maca na posição determinada para a análise das medidas. Durante a avaliação, alguns cuidados serão tomados para que o bem-estar do voluntário não seja prejudicado, são elas: o movimento será interrompido caso relatar desconforto no músculo ou reproduzir alguma compensação com o membro.

As medidas serão capturadas por uma câmera fotográfica, e posteriormente serão transferidas para o computador para serem analisadas pelo Software Sapo v. 0.69. Todas as informações e imagens serão utilizadas na pesquisa, não ocorrendo divulgação das mesmas em nenhum meio de comunicação. Não há risco de exposição de sua identidade, visto que os dados serão catalogados em forma de número e seu nome não aparecerá em qualquer instante.

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Agradecemos a sua participação e colaboração.
Você poderá entrar em contato com:

Pesquisador responsável: Prof. Alessandro Haupenthal (End.: Rua Padre Antônio Luis Dias, 500 ap 206 – Centro, Araranguá / SC; Contatos: e-mail: alessandro.haupenthal@ufsc.br / telefone: (48) 9902-8190).

Pesquisador: Carolina Holz Nonnenmacher (End Rua das Figueiras, 86, Urussanguinha, Araranguá / SC; Contatos: e-mail: carolinaholz10@gmail.com / telefone: (48) 9135-1386).

Comitê de Ética em Pesquisa com Seres Humanos da UFSC: End.: Prédio Reitoria II (Edifício Santa Clara), R: Desembargador Vitor Lima, nº 222, sala 401, Trindade, Florianópolis/SC CEP 88.040-400 - Campus Trindade/Florianópolis, pelo telefone: (048) 3721-6094 ou pelo e-mail: cep.propesq@contato.ufsc.br.

Eu,_____, após a leitura e compreensão destas informações, entendo que a minha participação é voluntária, e que posso sair a qualquer momento do estudo, sem prejuízo algum. Confirmo que recebi cópia deste termo de consentimento, e autorizo a execução do trabalho de pesquisa e a divulgação dos dados obtidos neste estudo.

_____	_____
Assinatura do Participante da Pesquisa	Assinatura do Pesquisador Responsável – Prof. Alessandro Haupenthal

Araranguá, _____ de _____ de 2021.

ANEXO A – NORMAS DA REVISTA

PHYSICAL THERAPY IN SPORT

Official journal of the Association of Chartered Physiotherapists in Sports and Exercise Medicine

AUTHOR INFORMATION PACK

TABLE OF CONTENTS

ISSN: 1466-853X

DESCRIPTION

Physical Therapy in Sport is an international peer-reviewed journal that provides a forum for the publication of research and clinical practice material relevant to the healthcare professions involved in **sports and exercise medicine, and rehabilitation**. The journal publishes material that is indispensable for day-to-day practice and continuing professional development. *Physical Therapy in Sport* covers topics dealing with the **diagnosis**, **treatment**, and **prevention** of **injuries**, as well as more general areas of **sports and exercise medicine** and related sports science.

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New guidance for randomised controlled trials

Physical Therapy in Sport has adopted the proposal from the International Committee of Medical Journal Editors (ICMJE) (see a recent Editorial in *Manual Therapy* http://www.sciencedirect.com/science/article/pii/S1356689X1200238X, Editorial: "Clinical trial registration in physiotherapy journals: Recommendations from the International Society of Physiotherapy Journal Editors"), which requires, as a condition of consideration for publication of clinical trials, registration in a public trials registry. Trials must register at or before the onset of patient

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Abstract

Articular cartilage is a unique biphasic material that supports a lifetime of compressive and shear forces across joints. When articular cartilage deteriorates, whether due to injury, wear and tear or normal aging, osteoarthritis and resultant pain can ensue. Understanding the basic science of the structure and biomechanics of articular cartilage can help clinicians guide their patients to appropriate activity and loading choices. The purpose of this article is to examine how articular cartilage structure and mechanics, may interact with risk factors to contribute to OA and how this interaction provides guidelines for intervention choices This paper will review the microstructure of articular cartilage, its mechanical properties and link this information to clinical decision making.

Highlights

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Conflict of Interest
Ethical Approval
Funding

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Magee, D.J. (1997). *Orthopaedic physical assessment.* (3rd ed.). Philadelphia: Saunders.
Reference to a chapter in an edited book:
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ANEXO B – APROVAÇÃO DO COMITÊ DE ÉTICA EM PESQUISA

UNIVERSIDADE FEDERAL DE SANTA CATARINA - UFSC

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: ANÁLISE DOS EFEITOS DA APLICAÇÃO DE RECURSOS TERAPEUTICOS NOS TECIDOS HUMANOS

Pesquisador: Alessandro Haupenthal

Área Temática:

Versão: 1

CAAE: 60397416.1.0000.0121

Instituição Proponente: Universidade Federal de Santa Catarina

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 1.771.454

Apresentação do Projeto:

'ANÁLISE DOS EFEITOS DA APLICAÇÃO DE RECURSOS TERAPÊUTICOS NOS TECIDOS HUMANOS". Estudo que visa analisar os efeitos da eletrotermofototerapia e da terapia manual aplicados aos tecidos humanos. Para aplicar uma intervenção efetiva o terapeuta precisa compreender como sua ação afeta os tecidos e sistemas do corpo e como os exercícios e recursos que pode utilizar se encaixam no processo de reabilitação funcional.

Objetivo da Pesquisa:

Objetivo Primário:

Objetivo Secundário:

a) Comparar o efeito dos diferentes métodos e a alteração da temperatura da pele;

b) Comparar o efeito dos diferentes métodos na amplitude de movimento articular;

c) Comparar o efeito dos diferentes métodos nos testes funcionais;

d) comparar o efeito dos diferentes métodos na escala analógico visual de dor

Avaliação dos Riscos e Benefícios:

Riscos:

Endereço: Universidade Federal de Santa Catarina, Prédio Reitoria II, R: Desembargador Vitor Lima, nº 222, sala 401
Bairro: Trindade **CEP:** 88.040-400
UF: SC **Município:** FLORIANOPOLIS
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Os riscos destes procedimentos serão baixos, por envolver avaliação como testes de capacidade de realizar exercícios como a caminhada e sentar e levantar de uma cadeira e a resposta de questionários. Apesar de não ser comum, durante o teste de caminhada ou o teste de sentar e levantar da cadeira, o participante poderá apresentar tontura, náuseas ou mal-estar e se isso acontecer, o teste será interrompido e havendo necessidade você
será atendido pela equipe que o acompanha durante os testes (estudantes e fisioterapeuta).
Durante a aplicação dos recursos será tomada algumas precauções para que o bem estar do participante não seja prejudicado. Mesmo não sendo comum, a aplicação do recurso terapêutico será interrompida caso o participante apresente relato de alteração ou desconforto na pele que cause incômodo, aumento ou diminuição da pressão arterial que traga mal estar, dor, indisposição ou cansaço extremo para realizar os testes, assim como
falta de ar, palpitações, náuseas ou tonturas.

Benefícios:
Os benefícios em participar deste estudo poderão repercutir na melhora do entendimento na aplicação dos recursos terapêuticos e consequentemente melhorará a qualidade de vida para os pacientes que serão posteriormente tratados. O estudo de qual modo e tipo de aplicação da modalidade é mais eficaz pode gerar também o aumento da efetividade do tratamento e a diminuição do tempo necessário para alcançar o objetivo da técnica e assim reduzindo a duração do atendimento durante a reabilitação.

Comentários e Considerações sobre a Pesquisa:
Trata o presente de um projeto de pesquisa de ALESSANDRO HAUPENTHAL do curso de Fisioterapia da Universidade Federal de Santa Catarina – UFSC, Campus Araranguá. Os recursos terapêuticos são uma das bases de tratamento para a fisioterapia e, no contexto deste projeto os recursos a serem aplicados são a eletrotermofototerapia e a terapia manual, entender e sanar as dúvidas dentro da aplicação destes recursos a partir das lacunas existentes na literatura pode auxiliar no processo de recuperação funcional terapêutica. Nesse contexto, esse estudo visa analisar os efeitos destas técnicas em 20 adultos por recurso a ser estudado. Os grupos dos diferentes métodos de intervenção serão submetidos a aplicação do método de tratamento e serão avaliados quanto aos efeitos de aquecimento ou resfriamento do tecido, amplitude de movimento articular, escala subjetiva da dor e testes funcionais. A comparação dos efeitos entre os diferentes métodos será realizada a partir da análise estatística inferencial com a aplicação do teste Shapiro Wilk para a normalidade dos dados e ANOVA com um intervalo de confiança de 95%. O estudo tem

relevância científica, a documentação apresentada está completa e o TCLE atende na íntegra a Resolução CNS nº466/12 e normas complementares. Assim, recomendamos a sua aprovação.

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Recomendações:

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Situação do Parecer:

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Necessita Apreciação da CONEP:

Não

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FLORIANOPOLIS, 11 de Outubro de 2016

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(Coordenador)