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Bruna Nascimento Zanfir da Silva

Confiabilidade da Teleavaliação da Mobilidade e Equilíbrio em Pacientes após Acidente Vascular Cerebral - Guia Para Avaliação Sistematizada

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BANCA AVALIADORA

____

Profa. Dra. Aline Scianni

Departamento de Fisioterapia e Terapia Ocupacional
Universidade Federal de Minas Gerais

____

Profa. Dra. Fabiana Carvalho

Programa de Pós-graduação em Epidemiologia
Núcleo Técnico-Científico de Telessaúde do Rio Grande do Sul
Universidade Federal do Rio Grande do Sul

____

Profa. Dra. Fernanda Cechetti

Departamento de Fisioterapia
Universidade Federal de Ciências da Saúde de Porto Alegre

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“E que o mínimo que a gente faça seja, a cada momento, o melhor que afinal se conseguiu fazer.”

Lya Luft

RESUMO

Objetivo: Verificar a confiabilidade de uma diretriz de sistematização da teleavaliação (OMPEPE) para avaliação da mobilidade e equilíbrio em indivíduos após Acidente Vascular Cerebral (AVC). **Métodos:** Vinte e cinco indivíduos com hemiparesia crônica pós AVC foram submetidos a avaliações presenciais e online com um intervalo de 24-48 horas entre elas. As avaliações online foram realizadas por videochamada. Usamos o *Timed Up and Go Test, 5-Time Sit-To-Stand Test, Functional Reach Test* e o *360 Degree Turn Test* para investigar os resultados de mobilidade e equilíbrio. Todas as avaliações foram realizadas por um único fisioterapeuta treinado. Um mês depois, os registros online foram reavaliados pelo mesmo fisioterapeuta e por um segundo investigador. **Resultados:** Encontramos forte concordância/correlação entre avaliações online e presenciais seguindo a diretriz da OMPEPE para todas as avaliações. Excelente confiabilidade intraavaliador e interavaliador foi encontrada para avaliações online (ICC >0,90), sugerindo que a teleavaliação é confiável para essa população. **Conclusões:** A teleavaliação é confiável para avaliar a mobilidade e o equilíbrio em indivíduos após AVC quando a avaliação online é planejada e realizada sistematicamente. Nossos resultados são dignos de nota pois a teleavaliação pode representar uma solução para monitorar pacientes após AVC e outros pacientes neurológicos quando os serviços de saúde presenciais são inviáveis.

ABSTRACT

Objective: To verify the reliability of a tele-assessment systematization guideline (OMPEPE) for assessing mobility and balance in individuals after stroke.

Methods: Twenty-five individuals with chronic post-stroke hemiparesis underwent in-person and online assessments with an interval of 24-48 hours in between. The online assessments were carried out via video call. We used the *Timed Up and Go Test, 5-Time Sit-To-Stand Test, Functional Reach Test* and *360 Degree Turn Test* to investigate mobility and balance outcomes. A single trained physiotherapist conducted all the evaluations. One month after, the online records were rescored by the same physiotherapist and by a second investigator.

Results: We found strong agreement/correlation between online and in-person evaluations following the OMPEPE guideline for all evaluations. Excellent intra-rater and inter-rater reliability were found for online assessments (ICC >0.90), suggesting that tele-assessment is reliable for this population.

Conclusions: Tele-assessment is reliable for assessing mobility and balance in post-stroke individuals when the online assessment is systematically planned and conducted. Our results are noteworthy because tele-assessment may represent a solution to monitor post-stroke and other neurological patients when in-person health services are impossible to conduct.

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LISTA DE ABREVIATURAS E SIGLAS

360TURN	*3*60 Degree Turn Test
5TSTS	5-Time Sit-To-Stand Test
AVC	Acidente Vascular Cerebral
AVDs	Atividades de vida diária
CI	Confidence Interval
COFFITO	Conselho Federal de Fisioterapia e Terapia Ocupacional
FMA	Fugl-Meyer Assessment
FRT	Functional Reach Test
ICC	Intraclass Correlation Coefficient
LL	Lower Limb
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
TUG	Timed Up and Go Test

SUMÁRIO

REVISÃO DE LITERATURA – CONTEXTUALIZAÇÃO

1.1 ACIDENTE VASCULAR CEREBRAL

Entre os distúrbios neurológicos, o Acidente Vascular Cerebral (AVC) é a doença que mais gera morte e incapacidade[1,2], sendo a segunda maior causa de morte no mundo[3,4]. No Brasil, é a principal causa de morte entre as mulheres e a segunda maior causa entre os homens e, de acordo com as estimativas da Organização Mundial da Saúde, o AVC seguirá sendo uma das principais causas de morte no mundo até pelo menos o ano de 2030[5,6]. Além de sua relação com o crescimento do envelhecimento populacional, a prevalência da doença está associada à fatores de risco como hipertensão arterial sistêmica, tabagismo, obesidade, sedentarismo, ingestão de álcool, estresse psicossomático, depressão, fatores cardíacos e nutricionais[7].

O AVC é definido como um quadro clínico resultante da perturbação focal ou global da função cerebral[8], podendo ser de etiologia isquêmica (quando há obstrução de um vaso sanguíneo, o que interrompe a irrigação sanguínea para o encéfalo) ou hemorrágica (quando há enfraquecimento da parede do vaso, resultando em rompimento e, consequentemente, extravasamento de sangue para a região irrigada por este vaso)[9]. A má perfusão encefálica após quadros isquêmicos ou hemorrágicos gera distúrbios sensório-motores, cognitivos e comportamentais. Os distúrbios sensório-motores resultam em hemiparesia, incoordenação motora, hipertonia espástica do membro superior e inferior contralaterais à lesão, além de fraqueza muscular generalizada[10,11]. Esses distúrbios podem diminuir a capacidade funcional dos indivíduos acometidos, limitando sua participação social e realização das atividades de vida diária (AVDs), especialmente tratando-se de déficits sensório-motores.

1.2 MOBILIDADE E EQUILÍBRIO

Os principais déficits sensório-motores após o AVC são fraqueza muscular, espasticidade e incoordenação motora, podendo influenciar negativamente a função motora do membro inferior, gerando padrões anormais e alterações no desempenho da marcha e mobilidade funcional[12]. Quase dois terços dos sobreviventes de AVC apresentam déficits iniciais de mobilidade e, seis meses após o AVC, mais de 30% dos sobreviventes ainda não conseguem deambular de forma independente[13].

Mesmo alcançando a deambulação independente, uma parcela dessa população apresenta déficits significativos na marcha, como redução da velocidade da marcha e da cadência, além de diminuição do comprimento da passada e do passo[14,15]. A diminuição da mobilidade afeta significativamente a independência e a autonomia dos indivíduos, levando a uma diminuição da participação social e dos níveis de atividade[16].

Outra das principais consequências sensório-motoras após o AVC é o déficit de equilíbrio, gerando grande impacto sobre a marcha e a independência nas AVDs[17]. É relatado que cerca de 83% dos sobreviventes de AVC apresentam comprometimento do equilíbrio. O déficit de equilíbrio é caracterizado por diferenças entre os dois lados do corpo e baixa velocidade de caminhada, o que pode aumentar o risco de quedas[14]. Sabe-se que pessoas pós AVC têm maior oscilação postural do que indivíduos da mesma idade que são saudáveis. Além disso, possuem padrões de distribuição de peso alterados, de modo que menos peso é distribuído na perna afetada, e têm excursões menores ao mover seu peso ao redor da base de suporte, especialmente na direção da perna afetada. Esse padrão é observado em todos os aspectos do equilíbrio (estático e dinâmico) e até mesmo em pessoas com AVC com altos níveis de função, como aquelas que deambulam[18-20]. Os problemas de equilíbrio após o AVC implicam na má recuperação das AVDs e na mobilidade, além de aumentar o risco de quedas[21,22]. Assim, destaca-se a importância de métodos eficazes de avaliação da mobilidade e do equilíbrio de indivíduos pós AVC para melhor planejamento das estratégias de reabilitação e recuperação funcional dessa população.

1.3 MEDIDAS CLÍNICAS

Atualmente estão disponíveis diversos instrumentos para avaliação do comprometimento motor, mobilidade e equilíbrio após AVC. Escalas clínicas como a avaliação de *Fugl-Meyer* (FMA) são amplamente divulgadas no âmbito da reabilitação para avaliação do comprometimento motor. A FMA foi desenvolvida com o intuito de quantificar o comprometimento sensório-motor de sujeitos após AVC, sendo amplamente utilizada na pesquisa e na prática clínica[23,24]. Essa escala clínica consiste em um sistema de pontuação numérica cumulativa que avalia cinco aspectos do sujeito com hemiparesia: amplitude de movimento, dor, sensibilidade, função motora e equilíbrio, totalizando 226 pontos. Esta escala tem um total de 100 pontos para a função motora normal, em que a pontuação máxima para o membro superior é 66 e para o membro inferior 34. O domínio de função motora engloba movimentação ativa (com sinergia e sem sinergia), coordenação motora e atividade reflexa. A avaliação motora do membro superior inclui mensuração do movimento, coordenação e atividade reflexa de ombro, cotovelo, punho e mão. Já a de membro inferior engloba quadril, joelho e tornozelo, sendo cada item classificado da seguinte forma: 0 – não pode ser realizado, 1 – realizado parcialmente e 2 – realizado completamente. A pontuação da FMA é também utilizada para classificar os pacientes de acordo com o nível de comprometimento motor, na qual menos de 50 pontos indica comprometimento motor severo; de 50-84 comprometimento marcante; de 85-95 comprometimento moderado; e de 96-100 comprometimento leve[24,25]. Também é possível classificar a gravidade do comprometimento motor separadamente. Para o membro inferior a classificação é de 0 a 19 pontos: grave, de 20 a 28 pontos: moderado e maior ou igual a 29 pontos: leve[26].

Para avaliação da cognição, o Mini Exame do Estado Mental (MEEM) têm sido amplamente utilizado para a população com acometimentos neurológicos[27]. O teste inclui 11 perguntas e requer cerca de 5-10 minutos para administração, sendo uma ferramenta prática e de fácil aplicação clínica. O teste é dividido em duas partes: a primeira requer apenas respostas vocais tratando-se de orientação, memória e atenção - a pontuação máxima é 21; a segunda parte testa a capacidade de nomear, seguir comandos verbais e escritos, escrever uma frase, e copiar a figura de um polígono - a pontuação máxima é 9. A pontuação total máxima do teste é 30[28]. Os pontos de corte para consideração de déficits cognitivos são: 13 para analfabetos, 18 para baixa e média escolaridade e 26 para alta escolaridade[29].

Ainda, há diversas ferramentas para avaliação de mobilidade e equilíbrio de indivíduos pós AVC, como o Timed Up And Go Test, o 5-Time Sit-To-Stand Test, o Functional Reach Test e o 360 Degree Turn Test, escolhidos como ferramentas de avaliação neste estudo por tratarem-se de testes amplamente utilizados para a população em questão e apresentarem fácil aplicabilidade/reprodutibilidade clínica.

1.3.1 TIMED UP AND GO TEST (TUG)

Descrito em 1991, o TUG teste consiste em: levantar de uma cadeira, caminhar ao longo de um percurso de três metros de distância em uma velocidade confortável, virar, voltar e sentar novamente na cadeira. O tempo para realizar a tarefa é cronometrado e a pontuação dada é o tempo gasto em segundos para completar o teste[30]. O teste TUG é uma ferramenta confiável, de fácil aplicação e amplamente utilizada para avaliação da mobilidade funcional em indivíduos com hemiparesia após AVC. Além disso, pode ser utilizado para avaliar o equilíbrio, a capacidade de caminhar e o risco de quedas. Pontuações acima de 14 segundos indicam maior risco de quedas nessa população[31].

1.3.2 5-TIME SIT-TO-STAND TEST (5TSTS)

O 5TSTS trata-se de um teste clínico de fácil administração e comprovadamente eficaz para avaliação de força muscular funcional dos membros inferiores em pessoas pós AVC. Para realização do teste o indivíduo é instruído a levantar e sentar em uma cadeira com os membros superiores cruzados à frente do peito, o mais rápido que puder, de forma segura, cinco vezes seguidas. O tempo para realizar a tarefa é cronometrado e, quanto maior o tempo, pior o desempenho. A pontuação de corte de doze segundos é discriminatória entre indivíduos idosos saudáveis e indivíduos pós AVC crônico[32]. Indivíduos com distúrbios do equilíbrio realizam o teste mais lentamente do que os sujeitos sem déficits de equilíbrio[33]. Além disso, em indivíduos pós AVC, a taxa significativamente menor de força e a maior oscilação postural ao levantar/sentar pode ser útil na identificação do risco de quedas[34].

1.3.3 FUNCTIONAL REACH TEST (FRT)

O FRT é um teste utilizado para avaliar o equilíbrio dinâmico e o alcance funcional do membro superior. Primeiramente, o indivíduo é instruído a ficar posicionado em pé ao lado de uma parede e flexionar o membro superior em um ângulo de 90 graus. O avaliador marca a posição inicial da extremidade distal do terceiro metacarpo na parede e, a seguir, o indivíduo é orientado a inclinar seu tronco à frente, o mais longe possível, sem tocar na parede e sem dar um passo. Então, o avaliador marca a posição final da extremidade distal do terceiro metacarpo na parede. O escore é determinado pela diferença em centímetros entre as posições inicial e final do alcance[35,36]. Valores de alcance menores de 15,24 centímetros indicam maior risco de quedas em adultos mais velhos[37].

1.3.4 360 DEGREE TURN TEST (360TURN)

O 360TURN é uma medida de equilíbrio dinâmico usada também para avaliar o nível de dependência funcional[38]. O teste é uma ferramenta confiável para avaliação da capacidade de virar de indivíduos com AVC crônico[39]. Para realização do teste, o indivíduo é instruído a ficar em ortostase com os pés confortavelmente afastados e os braços relaxados ao lado do corpo. Em seguida, é solicitado que realize uma volta completa (360 graus) em torno de seu próprio eixo, em velocidade usual. Durante o teste, mede-se o tempo para completar a volta e o número de passos dados para completar a volta. Pontuações acima de 3,8 segundos indicam maior taxa de dependência e pontuações acima de 9,1 segundos ou mais de 12 passos, indicam maior risco de quedas em indivíduos mais velhos[40].

1.4 TELEAVALIAÇÃO

Embora existam inúmeros métodos para avaliação da mobilidade e equilíbrio de indivíduos pós AVC, por vezes, há fatores que impossibilitam o acesso desses indivíduos aos serviços de saúde. A alta demanda dos serviços de saúde, questões econômicas, questões de localização geográfica e até mesmo condições de distanciamento social controlado em casos de pandemias, podem ser impeditivos para a avaliação, reabilitação e acompanhamento presenciais[41,42]. O acesso aos serviços de saúde tornou-se difícil em decorrência das restrições causadas pelo isolamento social durante a pandemia de coronavírus (COVID-19), levando a um aumento na popularidade dos serviços de telessaúde em todo o mundo[43,44]. No entanto, para além da época de isolamento social, existem outras barreiras ao atendimento de indivíduos pós AVC, como a distância geográfica e o tempo gasto no trajeto até os serviços de saúde e a escassez de consultas especializadas específicas em determinadas regiões[45].

Nesse cenário, a telessaúde pode representar uma solução para ampliar o acesso aos serviços de saúde, seja como alternativa à consulta presencial, ou como método adicional às formas tradicionais[43,46,47,]. A telessaúde é uma alternativa para ampliar a atenção à saúde de populações residentes em áreas rurais, com dificuldades de acesso aos serviços ou com escassez de especialistas, além de ajudar a reduzir os custos com saúde[42,48]. Telessaúde é, por definição, qualquer serviço de saúde fornecido através de tecnologias de telecomunicações[49]. Podendo incluir avaliação, terapia, educação, monitoramento e teleconsultoria, são reconhecidos diversos termos relacionados à telessaúde, como telediagnóstico, telereabilitação e telemonitoramento. A teleavaliação, ou telediagnóstico, ocorre por meio da transferência de dados audiovisuais entre o profissional avaliador e o paciente através de um dispositivo eletrônico. O serviço pode acontecer de forma síncrona, quando as informações são coletadas em tempo real (online), ou assíncrona, quando os dados são armazenados e encaminhados posteriormente[50].

Recentemente, o Conselho Federal de Fisioterapia e Terapia Ocupacional (COFFITO) autorizou, por meio da RESOLUÇÃO Nº 516, DE 20 DE MARÇO DE 2020, o atendimento não presencial nas modalidades de teleconsulta, teleconsultoria e telemonitoramento, dando à esses profissionais autonomia e independência para determinar quais pacientes ou casos podem ser atendidos ou acompanhados a distância. Com essa nova possibilidade, enfatiza-se a necessidade de estudos que comprovem a eficácia e confiabilidade da teleavaliação em populações específicas, em especial, populações com acometimentos neurológicos.

Um estudo anterior utilizando a teleavaliação para a avaliação física de indivíduos com doença de Parkinson demonstrou um alto nível de confiabilidade interavaliador e intra-avaliador, indicando que é possível avaliar a capacidade física de pessoas com doença de Parkinson por meio de sistemas de telereabilitação[51]. As medidas de mobilidade realizadas à distância em uma população saudável também demonstraram boa confiabilidade intra-avaliador, de acordo com um estudo anterior[52]. No entanto, desconhecemos evidências da confiabilidade da teleavaliação quando aplicada a indivíduos com comprometimentos mais pronunciados de mobilidade e equilíbrio, como é o caso daqueles com acometimentos neurológicos. Além disso, a falta de protocolos sistematizados gera dúvidas acerca da padronização das avaliações e precisão de suas medidas.

Dessa forma, enfatiza-se a necessidade da testagem de métodos e o estabelecimento de protocolos que garantam que os padrões de qualidade, éticos e legais sejam atendidos quando a avaliação é realizada à distância. Sendo assim, este estudo teve como objetivo verificar a confiabilidade de uma diretriz de sistematização da teleavaliação (OMPEPE) para avaliação da mobilidade e equilíbrio em indivíduos após Acidente Vascular Cerebral.

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3. OBJETIVOS

3.1 OBJETIVO GERAL

Desenvolver um guia para padronização da teleavaliação de mobilidade e equilíbrio em indivíduos pós AVC.

3.2 OBJETIVOS ESPECÍFICOS

- Verificar a confiabilidade de um guia de teleavaliação de mobilidade e equilíbrio em indivíduos após AVC.
- Avaliar a segurança e a confiabilidade da teleavaliação do *360 Degree Turn Test* em indivíduos após AVC.

4. ARTIGOS

4.1 ARTIGO 1

Tele-assessment of mobility and balance is reliable for post-stroke individuals – a guideline for a systematic physical evaluation

(to be submitted to the Journal of Telemedicine and Telecare - impact factor: 6.184)

Bruna Nascimento Zanfir da Silva[1,2], Camila Pinto[2,3], Caroline Santos Figueiredo[1,2], Katherine Lee Hsieh[4], Aline Souza Pagnussat[1,2,3,4]*

[1] Graduate Program in Rehabilitation Sciences, Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA), Brazil.

[2] Movement Analysis and Rehabilitation Laboratory, Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA), Brazil.

[3] Graduate Program in Health Sciences, Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA), Brazil.

[4] Department of Physical Therapy, Georgia State University, GSU, Atlanta, USA

***Correspondent author:**

Aline de Souza Pagnussat

Universidade Federal de Ciências da Saúde de Porto Alegre

245, Sarmento Leite Street
Zip Code:
90050-170
Porto Alegre RS, Brazil.
Phone: + 55-51-3303 8912
alinesp@ufcspa.edu.br

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Conflict of interest: None.

ABSTRACT

Objective: To verify the reliability of a protocol for tele-assessment for mobility and balance in post-stroke individuals. We established a guideline called OMPEPE to systematize the online evaluation. **Design**: Twenty-five individuals with chronic post-stroke hemiparesis underwent in-person and online assessments with an interval of 24-48 hours in between. The online assessments were carried out via video call. We used the Timed Up and Go Test, 5-Time Sit-To-Stand Test, and Functional Reach Test to investigate mobility and balance outcomes. A single trained physiotherapist conducted all the evaluations. One month after, the online records were rescored by the same physiotherapist and by a second investigator. **Results**: We found strong agreement/correlation between online and in-person evaluations following the OMPEPE guideline for all evaluations. Excellent intra-rater and inter-rater reliability were found for online assessments (ICC >0.90), suggesting that tele-assessment is reliable for this population. **Conclusions**: Tele-assessment is reliable for assessing mobility and balance in post-stroke individuals when the online assessment is systematically planned and conducted. Our results are noteworthy because tele-assessment may represent a solution to monitor post-stroke and other neurological patients when in-person health services are impossible to conduct.

Keywords: Telediagnostics, Telerehabilitation, Telemonitoring, Telehealth, Stroke, Neurological Rehabilitation.

INTRODUCTION

The social isolation brought about by the coronavirus pandemic (COVID-19) has made it challenging to access health services, leading to a surge in the popularity of telehealth services worldwide[1]. In this scenario, telehealth or remote assistance may represent a solution to expand access to health services, as an alternative to face-to-face consultation, or even as an additional method to traditional forms (Russel, 2009; Thomas, 2022; Maeyama, 2018)[2-4]. Telehealth is an alternative for expanding healthcare to populations residing in rural areas, experiencing difficulties in accessing services, or facing a shortage of specialists. Telehealth also helps to reduce healthcare costs[5,6].

Telehealth refers to any healthcare service delivered through telecommunications technologies, encompassing online assessment, therapy, education, monitoring, and teleconsultation[7]. Specifically, the tele-assessment takes place through the transfer of audiovisual data between a professional evaluator and the patient, using an electronic device. The service can occur synchronously, in which information is collected in real-time (online), or asynchronously, in which data is stored and forwarded later[8]. Effective evaluation methods are essential for the diagnosis, rehabilitation planning, and follow-up of individuals with neurological diseases, particularly for those who have suffered a stroke[9]. Notably, improving tele-assessment methods for neurological patients is crucial to ensure the reproducibility and safety of this type of evaluation.

Stroke is one of the main causes of death and disability in the world, and loss of mobility is one of the main complaints of this population[10]. Rehabilitation promptly after a stroke can improve mobility and reduce the development of disability. Additionally, even after participating in neurorehabilitation programs, individuals may continue to experience functional limitations that require ongoing health monitoring[11-13]. Thus, post-stroke patients can benefit from tele-assessment services in both acute and chronic phases. For this purpose, it is important that the clinical assessments already used for this population have their reliability tested in an online format so that they can be carried out reliably and safely. The tests included in this study were chosen due to their widespread use for this population and also for their practical applicability.

A previous study that has examined tele-assessment procedures in neurological diseases (i.e., Parkinson's disease) found a high level of inter- and intra-rater reliability[14]. Mobility tele-assessment of a healthy population also exhibits good intra-rater reliability[15]. However, there is a lack of evidence regarding the reliability of tele-assessment when applied to individuals with more severe mobility and balance impairments, particularly after a stroke. Additionally, the lack of systematized protocols raises concerns regarding the standardization of assessments and the accuracy of their measurements. Therefore, our objective here was to develop and investigate the reliability of a protocol for standardizing tele-assessment of mobility and balance in post-stroke individuals, using Timed Up and Go Test (TUG), 5-Time Sit-To-Stand Test (5TSTS) and Functional Reach Test (FRT).

METHODS

This observational study was approved by the Ethics and Research Committee of the Universidade Federal de Ciências da Saúde de Porto Alegre (number: 45137321.5.0000.5345).

Participants

Participants were recruited for convenience between December 2020 and October 2022 through advertising on social media and in hospitals in the city of Porto Alegre and its surrounding metropolitan area, Brazil. Subjects were considered eligible if they attended the following inclusion criteria: older than 18 years; diagnosis of chronic stroke (>6 months) with mild, moderate, or severe hemiparesis, according to Fugl-Meyer Assessment (FMA)[16]; no cognitive impairment (minimum score of 20 points in the Mini-Mental State Examination)[17]; ability to walk independently for at least 3 meters, with or without walking devices; having a cell phone, tablet, or computer with a camera and internet access where evaluations could be carried out; basic knowledge of video-conferencing (participant themselves or another person assisting them); a full-time caregiver or family member available during the online assessments; sign the informed consent form. Individuals who had a clinical diagnosis of secondary musculoskeletal disorders that could affect their performance in the assessments, any unstable or severe illness that could interfere with the assessments, any peripheral neurological or musculoskeletal condition that could impact balance and gait, a history of neurosurgery or orthopedic surgery resulting in gait limitation, or significant visual deficits without corrective prescription lenses were excluded from the study.

Procedures

Participants were assessed twice using the same tests: one evaluation was conducted in person and another one virtually (tele-assessment). The interval between evaluations was between 24-48h. The order of evaluations (in person and virtually) was randomly determined. The order in which the tests were applied was also randomly determined. The same trained physical therapist (B.Z.) conducted both the in-person and online assessments. In-person assessments were conducted at the participants' residences, while tele-assessments were conducted through videoconferencing using the below-mentioned guideline. Prior to each test, a tutorial video was presented to the individual to explain the steps involved in the test, and any questions or doubts were addressed. All tests included in the online assessment were video recorded. After one month, the first evaluator re-watched the recorded tests to verify intra-rater reliability. For inter-rater reliability, a second physical therapist (C.F.) watched and evaluated the recorded video assessments (as shown in Figure 1). The second physical therapist was blinded to the results. For the online assessments, participants were able to use any device with a camera and internet access (computer, tablet, or cell phone). The materials needed to perform the tests, including the cone, measuring tape, and marking tapes, were provided by the researchers of the study, while the chair used was provided by the participants themselves. A stopwatch was used to time the tests.

Figure 1 here

OMPEPE Guideline

We developed a guideline to explain each physical test, providing instructions to the participants on:

O - Objective: objectives and purposes of the test;
M - Material: materials required to carry out the test;
P - Initial position: initial position required to start the test;
E - Execution: performance expected for each test, including how to perform the test correctly, how not to perform it, and possible errors and compensations;
P - Final position: final position expected to conclude the test;
E - Environment: how to organize the testing environment/space to ensure feasibility and safety.

Before the assessments, the researcher asked the participants if they had: 1) taken their medications according to their individual routine; 2) worn appropriate clothing and shoes; 3) eaten and hydrated adequately; 4) refrained from performing any physical exercise prior to the test; 5) ensured all necessary materials were available; and 6) arranged for a companion to be present. The guideline for each test is presented in Supplementary Material 1.

Clinical measures

The motor section of the Fugl Meyer Assessment (FMA) scale was used to assess the motor impairment of the lower limbs (LL). Severity was stratified according to the score, considering severe impairment scores from 0 to 19, moderate impairment from 20 to 28, and mild impairment ≥29[16].

Timed Up and Go Test

The Timed Up and Go Test was used to assess the participants' level of functional mobility[18]. The test involves measuring the time it takes for individuals to rise from a chair, walk three meters, navigate around a cone, return to the chair, and sit back down. Participants were instructed to perform the test at their usual pace, choosing the side they would like to walk around the cone. They were also allowed to use a walking device if necessary. The test was conducted three times. The same instructions were given for in-person and tele-assessments.

5-Time Sit-To-Stand Test

The 5-Time Sit-To-Stand Test was used to evaluate the strength and endurance of the lower limbs. Participants were instructed to stand up and sit down on a chair with their arms crossed in a safe and timely manner, completing the task five times in a row[19]. Participants could compensate for the standing transfer by using their upper limbs to assist with the lift if necessary. The test was repeated three times. The same instructions were given for in-person and tele-assessments.

Functional Reach Test

The Functional Reach Test was used to evaluate dynamic balance and functional reach. Participants were instructed to stand beside a wall and flex their upper limb at a 90-degree angle. The evaluator marked the initial position of the third metacarpal's distal end on the wall and then instructed the participant to reach forward as far as possible without touching the wall, using the verbal command "reach as far as you can without taking a step". The evaluator marked the final position of the third metacarpal's distal end on the wall. The test was performed three times, and the scores were determined by measuring the difference in centimeters between the initial and final positions[20-21]. If participants could not lift the affected arm, they were instructed to perform the reaching movement using their unaffected arm. During tele-assessments, the participant's caregiver or family member was responsible for marking and measuring the distance between the initial and final positions of the reaching task. The measurement was then shared with the evaluator to determine the participant's score.

Safety

Safety was determined by monitoring the incidence of adverse events, including falls or near falls, cardiovascular events, and musculoskeletal injuries. Participants and their family members were instructed on what to do in case there were any issues during the tests.

Statistical Analysis

The sample size was calculated using the WinPepi Software (http://www.brixtonhealth.com/pepi4windows.html), based on a previous study[22]. To ensure a minimum agreement of r=0.9, with a power of 90% and a significance level of 5%, the sample size was estimated at 25 subjects.

Data analysis was performed using SPSS 29.0 software (Statistical Package for the Social Sciences, Inc., Chicago, USA). The Shapiro-Wilk test was used to assess the normality of continuous variables. Data were expressed as mean and 95% confidence intervals (continuous variables) and frequency distribution (categorical variables).

Reliability was measured using the Intraclass Correlation Coefficient (ICC) Test to compare in-person versus synchronous tele-assessment, synchronous versus asynchronous tele-assessment, and asynchronous (rater 1) versus asynchronous (rater 2) tele-assessment. We adopted the following values for reliability: <0.5 poor correlation, between 0.5 and 0.75 moderate correlation, between 0.75 and 0.9 good correlation, and >0.9 excellent correlation. The Wilcoxon test was used to compare in-person versus synchronous tele-assessment. Results were considered significant if $p < 0.05$. The statistical analysis was conducted by averaging three repetitions for all tests.

RESULTS

Participants

Forty-three subjects were recruited for this study. Eighteen subjects were excluded based on eligibility criteria. Twenty-five post-stroke individuals with chronic hemiparesis were included (Figure 2). The sample's characteristics are depicted in Table 1. The detailed results of evaluations are presented in Supplementary Material 2.

Figure 2 here

Table 1 here

In-person versus Tele-assessment

All participants completed the full evaluation protocol except for one participant who experienced a technical problem(i.e., battery ran out) during the FRT test and was therefore excluded from the analysis. Our analysis revealed that the reliability of all tests, including TUG, 5TSTS, and FRT, was good (ICC > 0.75) to excellent (ICC > 0.90) when comparing in-person and tele-assessments. Moreover, we did not detect any significant difference between the scores obtained from the in-person and tele-assessment methods for these tests (p > 0.05 for all) (Table 2). Furthermore, we did not observe any adverse events during the evaluations.

Table 2 here

Intra-rater and inter-rater reliability

Table 3 summarizes the results of two investigations: a) a comparison between the online assessments conducted synchronously and asynchronously by the same rater after one month (to verify intra-rater reliability); b) a comparison between the online assessments conducted asynchronously by the first and second raters (to verify interrater reliability). The intra-rater and inter-rater reliability of the TUG and 5TSTS tests were excellent (ICC > 0.90). However, we were unable to evaluate the intra-rater and inter-rater reliability of the FRT due to the measurement method used in tele-assessments. During the tele-assessment, the caregiver or family member was instructed to conduct and report the test results to the evaluator, making it impossible to assess the measurement consistency during the review after the evaluation.

Table 3 here

Discussion

This study investigated the reliability of a protocol for tele-assessment of mobility and balance in individuals after a stroke. We developed a guideline called OMPEPE to standardize the online evaluation process. Our results demonstrated a high level of agreement between the tele-assessment and in-person measurements, indicating excellent intra-rater and inter-rater reliability for the online format. Moreover, no adverse events, such as falls or near falls, were observed during the experiment. Therefore, our findings suggest that tele-assessment is a safe and reliable method for evaluating balance and mobility in post-stroke individuals.

We found a strong correlation between in-person and tele-assessments for TUG, 5TSTS, and FRT tests when following the OMPEPE guideline. The online assessments demonstrated excellent intra-rater and interrater reliability (ICC > 0.90), suggesting that tele-assessment is reliable for evaluating post-stroke individuals. However, caution should be exercised when different examiners perform the TUG and 5TSTS tests online, despite our study's excellent level of intra-rater and inter-rater reliability (ICC > 0.90). It's worth noting that the excellent consistency observed between different raters measuring the same phenomenon (inter-rater) could be subject to bias, as the assessment format differed between them (online asynchronous vs. online synchronous). A previous study assessed the intra-rater and inter-rater reliability of online and in-person testing for balance and mobility in healthy individuals, reporting good inter-rater reliability for the 5TSTS, moderate inter-rater reliability for the TUG, and good intra-rater reliability for the TUG and moderate for the 5TSTS[15]. A systematic review that assessed the effectiveness of physiotherapy assessments delivered through telehealth found that assessments requiring observation and/or timing, such as the TUG test, had good feasibility compared to in-person assessments[23].

Although tele-assessment is a convenient way to monitor patients remotely, some barriers and limitations must be considered. In our study, we experienced delays in some tele-assessments due to technical difficulties faced by certain participants and their companions, particularly those who were elderly or had lower levels of education. Another significant barrier we encountered was poor internet connectivity resulting in disconnection or delays. In such cases, the evaluation had to be restarted. For future studies, we suggest that the quality of the internet be tested beforehand, as well as the technical knowledge of the participants or their caregiver or family member regarding the use of technology. Additionally, the home environment posed significant challenges, including noise, visual distractions, and other external interferences. Furthermore, the limited physical space sometimes required assessments to be carried out in unconventional places such as hallways or garages. However, despite these challenges, both in-person and tele-assessments were conducted similarly. It's important to note that this study has limitations. For example, participants' perceptions of tele-assessments were not investigated, and thus, the barriers and facilities we encountered should be interpreted with caution.

Our study highlights the reliability of tele-assessment for evaluating mobility and balance in post-stroke individuals. We provided evidence that establishing and following a systematic guideline for tele-assessment may ensure accurate and safe measurements and evaluations. Tele-assessment following the OMPEPE guideline demonstrated excellent intra-rater and inter-rater reliability, indicating that tele-assessment is a reliable alternative to in-person assessments when properly conducted. Our results may have important implications for the care of post-stroke patients and other neurological patients. Tele-assessment may represent a valuable tool for monitoring the mobility and balance of post-stroke patients who face challenges in accessing in-person healthcare services. This study's findings also encourage the development of tele-assessment guidelines and protocols for other health conditions, improving access to care for patients with limited mobility or who live in remote areas.

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4.2 ARTIGO 2 - BRIEF COMMUNICATION

BRIEF COMMUNICATION

Is the 360 Degree Turn Test a safe and reliable tool for post-stroke tele-assessment?

To be submitted to Telemedicine and e-Health (impact factor: 5.033)

Bruna Nascimento Zanfir da Silva[1,2], Camila Pinto[2,3], Caroline Santos Figueiredo[1,2], Katherine Lee Hsieh[4], Aline de Souza Pagnussat[1,2,3,4]*

[1] Graduate Program in Rehabilitation Sciences, Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA), Brazil.

[2] Movement Analysis and Rehabilitation Laboratory, Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA), Brazil.

[3] Graduate Program in Health Sciences, Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA), Brazil.

[4] Department of Physical Therapy, Georgia State University, GSU, Atlanta, USA

***Correspondent author:**

Aline de Souza Pagnussat

Universidade Federal de Ciências da Saúde de Porto Alegre

245, Sarmento Leite Street

Zip Code: 90050-170

Porto Alegre RS, Brazil. Phone:

+ 55-51-3303 8912

alinesp@ufcspa.edu.br

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ABSTRACT

Objectives: Assess tele-assessment safety and reliability of 360 Degree Turn Test in post-stroke individuals. **Methods:** We included 25 chronic post-stroke individuals who were tested both in-person and online with a 24-48 hour interval between assessments. The online assessments were conducted via video call by a trained physiotherapist and were rescored by the same physiotherapist and a second investigator one month later. **Results:** We found a strong level of agreement between in-person and tele-assessment (ICC>0.90). Tele-assessment demonstrated excellent intra-rater and inter-rater reliability. However, participants took significantly longer to complete the test in the tele-assessment (p-value <0.05). No adverse events occurred during the experiment, such as falls or near falls. **Conclusions:** The 360 Degree Turn Test tele-assessment is reliable and safe for assessing post-stroke balance. Based on our results, we do not recommend using a mixed evaluation method combining in-person and online testing for the same patient.

Keywords: Telediagnostics, Telerehabilitation, Telemonitoring, Telehealth, Stroke, Neurological Rehabilitation.

Introduction

Stroke is a leading cause of long-term disability worldwide[1]. Several motor impairments after stroke, such as muscle weakness, increased muscle tone, and lack of coordination may impair balance and turning movements[2,3]. For stroke patients, balance assessment may be crucial for monitoring clinical progress and planning rehabilitation strategies[4]. However, traditional in-person balance assessment may not always be feasible for various reasons, such as the patient's physical condition, transportation barriers, and time constraints[5,6]. Tele-assessment is an emerging approach to overcome these challenges and provide remote telehealth care to many patients, including those after a stroke[7-10].

A well-established method to assess balance in post-stroke individuals is the 360 Degree Turn Test[11]. During this test, the patient's dynamic balance and level of functional independence are assessed as they complete a full circle turn (360 degrees). The test records the time to complete the turn and the number of steps taken [12]. The 360 Degree Turn Test has been studied as an assessment tool for community-dwelling older adults and post-stroke patients[11]. In healthy older adults, those who took more than 3.8 seconds to complete the turn were at a higher risk of falling and losing independence in their daily living[12]. Additionally, the 360-degree turn times were significantly correlated with walking speed and timed chair rise in healthy older adults[13]. For post-stroke patients, the 360 Degree Turn Test has excellent reliability with a minimal detectable change value of 0.76 and 1.22 seconds for turning toward the affected and unaffected sides, respectively. The test has cutoff times of 3.49 and 3.43 seconds for turning toward the unaffected and affected sides, respectively, to distinguish between healthy older adults and stroke survivors. The 360 Degree Turn Test also correlates with other measures of physical function such as Fugl-Meyer assessment of the lower extremity, Berg Balance Scale, five times sit-to-stand, Timed Up and Go, among others[11].

Although the 360 Degree Turn Test is reliable and easily administered in post-stroke individuals[11], the safety and reliability of this test via tele-assessment have not been fully explored. Thus, our aim here was to assess the safety and reliability of tele-assessment using the 360 Degree Turn Test in post-stroke individuals.

Methods

This observational study was conducted following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)[14] checklist and was approved by the Ethics and Research Committee of the Universidade Federal de Ciências da Saúde de Porto Alegre (number: 45137321.5.0000.5345). Participants were recruited for convenience between December 2020 and October 2022. We included participants who were 18 years or older and had been diagnosed with chronic stroke (>6 months) presenting mild, moderate, or severe hemiparesis, according to Fugl-Meyer Assessment[15]. Subjects were considered eligible if they attended the following inclusion criteria: no cognitive impairment (minimum score of 20 points in the Mini-Mental State Examination)[16]; having a cell phone, tablet, or computer with a camera and internet access where evaluations could be carried out; basic knowledge of video-conferencing (participant themselves or another person assisting them); a full-time caregiver or family member available during the online assessments; sign the informed consent form. Eligible individuals who agreed to participate in the study signed a free and informed consent form.

Each participant underwent two random assessments that included the same tests, one was conducted in person, and the other was online. An interval of 24-48 hours was provided between them. The order in which the evaluations were conducted was randomized in blocks. Both the in-person and online assessments were conducted by the same physical therapist, who visited the participants' residences for the in-person assessment and instructed them through videoconferencing for the online assessment. A full-time caregiver or family member was required to be present during the online assessments. A guideline (OMPEPE) developed by the researchers was used to explain the performance of the online test to the participants. The guideline is presented in Supplementary Material 1. To ensure that each participant understood the steps of the test, a tutorial video was shown before each assessment, and any questions or concerns were addressed. Additionally, all the tests included in the online assessment were recorded. One month later, the evaluator reviewed the tests once more to confirm the intra-rater reliability. A second physical therapist reviewed and evaluated the recorded video assessment to assess interrater reliability. Safety was determined by recording any adverse events that occurred during the assessments, including falls or near-falls, cardiovascular events, and musculoskeletal injuries.

The 360 Degree Turn Test was utilized to assess the dynamic balance of the participants. First, the individual was instructed to stand with their feet comfortably apart and their arms relaxed at their sides. They were then asked to complete a full turn (360 degrees) around their axis at their normal speed. During this process, the time to complete the turn and the required steps were recorded. Each participant performed three attempts in each direction[11].

The sample size was determined using WinPepi software (http://www.brixtonhealth.com/pepi4windows.html) based on a previous study[17]. To ensure a minimum agreement of $r=0.9$, with a power of 90% and a significance level of 5%, the estimated sample size was 25 subjects. Data analysis was conducted using SPSS 29.0 software (Statistical Package for the Social Sciences, Inc., Chicago, USA). The normality of continuous variables was assessed using the Shapiro-Wilk test. Continuous variables were expressed as means and 95% confidence intervals, while categorical variables were expressed as frequency distributions. The reliability of the assessments was measured using the Intraclass Correlation Coefficient (ICC) test. We used the following criteria to evaluate the reliability: <0.5 indicated poor correlation, between 0.5 and 0.75 indicated moderate correlation, between 0.75 and 0.9 indicated good correlation, and >0.9 indicated excellent correlation. We compared in-person versus synchronous tele-assessment, synchronous versus asynchronous tele-assessment, and asynchronous (rater 1) versus asynchronous (rater 2) tele-assessment. The Wilcoxon test was used to compare in-person versus synchronous tele-assessment. Results were considered statistically significant if $p < 0.05$.

Results

We included twenty-five individuals with post-stroke chronic hemiparesis. The characteristics of the participants are detailed in Table 1. All participants completed the entire evaluation protocol.

Table 1 here

We found excellent reliability (ICC >0.90) for the 360 Degree Turn Test when comparing in-person and tele-assessment. However, participants took significantly longer to complete the test during the tele-assessment (p-value <0.05) (Table 2).

Table 2 here

The 360 Degree Turn Test demonstrated excellent intra-rater reliability (when comparing online synchronous and online asynchronous). The test also presented excellent inter-rater reliability (ICC >0.90), as depicted in Table 3. This result suggests that the test can produce consistent results when administered by the same evaluator over time and when administered by different evaluators.

Table 3 here

Discussion

This study aimed to evaluate the reliability and safety of using tele-assessment to perform the 360 Degree Turn Test on post-stroke individuals. The study findings revealed that tele-assessment using the 360 Degree Turn Test yielded highly consistent results, as evidenced by the agreement between in-person and online assessments and the excellent intra-rater and inter-rater reliability scores. Additionally, no adverse events were reported, even considering a sample composed of moderately- severely compromised patients. This result indicates that the 360 Degree Turn Test conducted through tele-assessment is a safe evaluation strategy for post-stroke individuals.

Notably, this agreement refers to the similarity or consistency level between the two forms of delivering the test and between two evaluators assessing the same patient. However, it does not mean that the results obtained by in-person and tele-assessment are identical. Here we demonstrated that participants took longer to complete the test during the tele-assessment. Considering the minimal detectable change values of 0.76 and 1.22 seconds for turning toward the affected and unaffected sides, respectively[11], the observed difference between the two administration methods we found here (1.17 for the affected side and 0.77 for the unaffected side) was both statistically and clinically significant for the affected side. Hence, combining in-person and online testing for the same patient may not be advisable, as it has the potential to produce varying results.

Tele-assessment using the 360 Degree Turn Test is a reliable and safe method for assessing the balance of post-stroke individuals when in-person care is not possible or feasible. While it is noteworthy that the interrater reliability scores were excellent, indicating consistent measurements of the same phenomenon, it is important to consider the potential for bias as the raters used different assessment formats (online asynchronous vs. online synchronous). Additionally, it is important to note that participants may take longer and require more steps to complete the test during tele-assessment. Clinicians should consider these factors when conducting tele-assessments and may need to adjust their expectations accordingly. Additionally, a mixed evaluation method combining in-person and online testing for the same patient may not be the most effective approach. Finally, we followed a standardized guideline during the test administration, which we believe has influenced the high level of agreement in our evaluations. Overall, our findings highlight the potential benefits and limitations of post-stroke balance tele-assessment.

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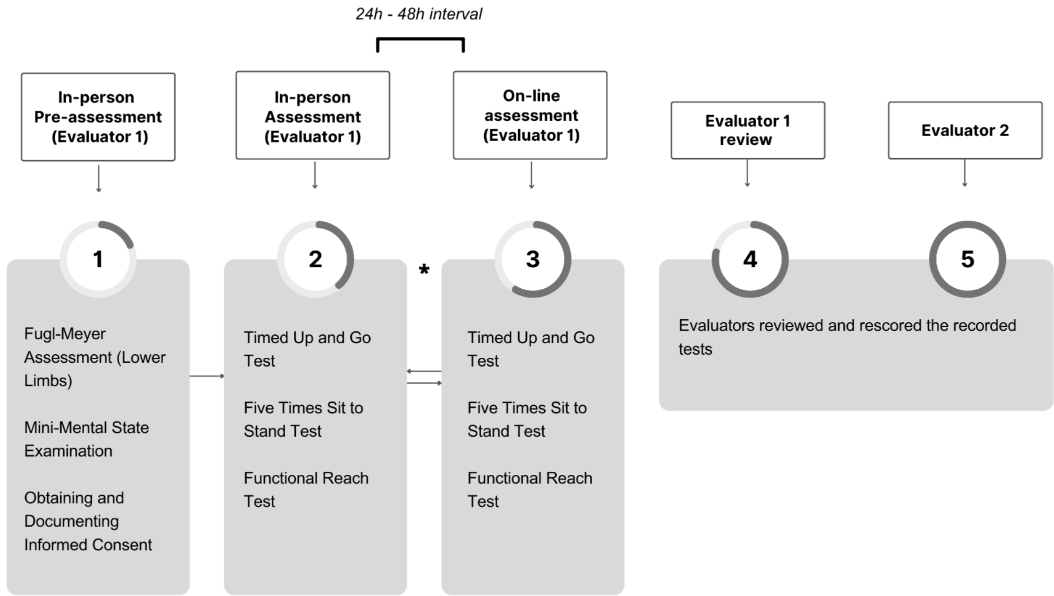
FIGURAS E TABELAS

ARTIGO 1

FIGURE 1

Figure 1 - Assessments flow chart.



Note: *: The order of evaluations was randomized into blocks.

FIGURE 2

Figure 2 - Recruitment process flow chart.

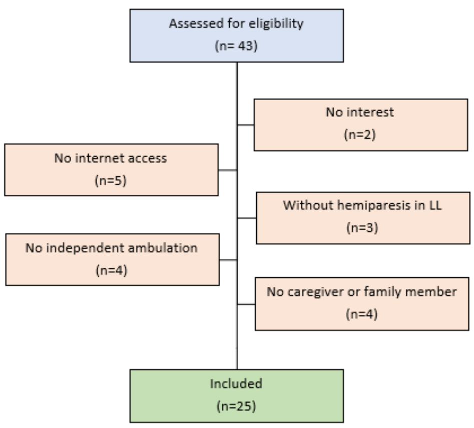


TABLE 1

Table 1 – Sample's characteristics.

Variables	Post-stroke individuals (n=25)
Age (years)	60.9 (55.70-66.13)
Gender (Male/Female)	18/7
Educational level Basic education	5
High school	4
Higher Education	16
Time since stroke (months)	55 (35.51-74.48)
Stroke type (Ischemic/Hemorrhagic)	17/8
Affected side (Right/Left)	8/17
Mini-Mental State Examination	27.3 (26.12-28.43)
FMA-LL (Severe/Moderate)	13/12

Note: Data are expressed as frequencies, means, and standard deviations. FMA-LL: Fugl-Meyer Assessment - lower limb; n: number of participants.

TABLE 2

Table 2 - In-person *versus* tele-assessment.

Test	**In-person**	**Tele-assessmnet (synchronous)**	**P-value**	**ICC (95% CI)**
TUG (s)	40.36 (26.46-54.26)	40.10 (26.25-53.95)	0.861	0.98
5TSTS (s)	24.47 (20.52-28.42)	25.22 (20.91-29.54)	0.527	0.95
FRT (cm)	19.56 (16.72-22.40)	18.96 (15.43-22.49)	0.742	0.84

Note: Data are expressed as means and standard deviations. TUG: Timed Up and Go Test; 5TSTS: 5-Time Sit-To-Stand Test; FRT: Functional Reach Test. ICC: Intraclass Correlation Coefficient.

TABLE 3

Table 3 - Intraclass correlation coefficient (ICC) for inter-rater and intra-rater reliability.

Assessment	Rater 1 on-line synchronous	Rater 1 on-line asynchronous	ICC (95% CI)	Rater 2 on-line asynchronous	ICC (95% CI)
TUG (s)	40.10 (26.25-53.95)	40.00 (26.24-53.77)	1.00 (1.00-1.00)[a]	39.82 (26.18-53.45)	1.00 (1.00-1.00)[b]
5TSTS (s)	25.22 (20.91-29.54)	25.25 (20.94-29.56)	1.00 (1.00-1.00)[a]	25.15 (20.87-29.44)	1.00 (1.00-1.00)[b]

Note: Data are expressed as means and standard deviations. TUG: Timed Up and Go Test; 5TSTS: 5-Time Sit-To-Stand Test; ICC: Intraclass Correlation Coefficient. CI: confidence interval. a – intra-rater reliability. b – inter-rater reliability.

SUPPLEMENTARY MATERIAL 1

Supplementary Material 1 - OMPEPE guideline.

Timed Up and Go Test	
O	We will administer this test, which is called Timed up and Go to evaluate your functional mobility, which refers to your ability to move around to perform everyday activities.
M	You will require the following materials to conduct the test: a measuring tape, a chair, and a cone. The cone should be placed 3 meters away from the chair.
P	To begin the test, you must be in a seated position on the chair.
E	When I give you the command, stand up from the chair, walk the distance of 3 meters, go around the cone, come back to the starting point, and then sit down on the chair at your usual or comfortable speed.
P	At the end of the test, your position should be sitting on the chair again.
E	The testing area must be clear of any obstacles or objects that could disrupt the test or draw your attention away. The test can be conducted indoors, in a hallway, or a garage, as long as the area is at least 3 meters in length.
Observation: We will perform the test three times to ensure accuracy. You can use devices to aid during the test, such as crutches if necessary.	

Five Times Sit to Stand Test	
O	We will administer this test, which is called Five Times Sit to Stand Test to assess the strength and endurance of your legs.
M	The only item required for this test is a chair.
P	To initiate the test, make sure you are seated on the chair, with your feet firmly on the floor and your arms crossed in front of your chest.
E	When I give you the command, you should stand up and sit down five times as fast as you can.

P	At the end of the test, your position should be sitting on the chair again.
E	The testing area must be clear of any obstacles or objects that could disrupt the test or draw your attention away. The chair must be placed on the floor in a stable and safe way.
Observation: We will perform the test three times to ensure accuracy.	

Functional Reach Test	
O	We will administer this test, which is called Functional Reach Test to assess your dynamic balance, which is your ability to maintain balance while moving.
M	You will require the following materials to conduct the test: measuring tape and sticky tape.
P	To begin the test, stand next to a wall, with your side facing the wall, and make sure that you do not touch the wall during the test.
E	Please flex your arm to a 90-degree angle when I give you my first command. Your assistant will mark the farthest point reached by your third finger on the wall. Once I give you the second command, you should lean your body forward, reaching as far as you can without taking a step or touching the wall. Your assistant will mark the new location where your third finger reaches. Your assistant should then measure the distance in centimeters between the starting and final positions.
P	Once you have reached as far as possible, please return to the starting position in a relaxed manner, with your side facing the wall.
E	The testing area must be clear of any obstacles or objects that could disrupt the test or draw your attention away.
Observation: Please perform the reaching movement with your affected arm. If you are unable to do so, you may use your unaffected arm instead. If you are unable to lift either arm, simply lean your torso forward, and we will measure the distance covered by your shoulder. We will perform the test three times to ensure accuracy.	

SUPPLEMENTARY MATERIAL 2

Supplementary Material 2 - Detailed results obtained from evaluations conducted in-person and though tele-assessment.

			IN-PERSON ASSESSMENT			ON-LINE SYNCHRONOUS ASSESSMENT			PHYSICAL THERAPIST 2 REVIEW		
	Participants	FMA-MI	TUG (s)	5TSTS (s)	FRT (cm)	TUG (s)	5TSTS (s)	FRT (cm)	TUG (s)	5TSTS (s)	FRT (cm)
MODERATE	1	27	24,21	31,27	18,50	26,19	27,42	15,33	26,13	27,87	15,33
	2	27	11,38	10,42	37,67	12,13	13,91	37,83	12,56	13,87	37,83
	3	27	17,96	30,21	11,50	18,60	25,89	11,00	19,06	25,66	11,00
	4	23	14,03	16,11	12,33	13,96	14,09	14,00	14,54	14,15	14,00
	5	23	15,38	19,01	21,83	17,89	27,21	11,00	18,07	27,06	11,00
	6	23	31,36	23,53	20,33	30,26	24,23	19,00	30,21	24,46	19,00
	7	22	18,46	24,47	25,33	18,89	22,96	31,83	18,89	22,84	31,83
	8	22	10,31	9,62	12,17	10,03	11,89	18,00	11,01	12,85	18,00
	9	22	11,56	11,79	25,67	12,25	14,06	30,00	11,56	14,51	30,00
	10	20	22,67	27,85	22,00	19,24	27,37	12,00	18,77	29,93	12,00
	11	20	20,34	15,26	27,00	19,48	16,67	29,33	19,07	15,91	29,33
	12	20	21,09	20,17	18,67	19,86	21,18	13,67	20,14	21,32	13,67
SE	1	19	48,26	32,70	12,00	52,63	34,54	20,17	52,06	34,38	20,17
	2	19	13,51	15,18	28,83	15,15	16,48	17,67	15,41	16,54	17,67
	3	17	57,33	25,12	19,75	53,81	17,67	20,00	54,03	17,18	20,00

V E R E	4	16	98,35	25,24	16,00	100,81	30,80	25,00	99,02	30,33	25,00
	5	15	19,59	35,04	23,33	21,89	47,73	26,00	21,87	47,07	26,00
	6	15	87,85	22,79	23,33	104,91	23,88	27,17	105,47	23,46	27,17
	7	15	111,49	24,29	-	82,25	22,89	-	82,03	22,68	-
	8	14	98,20	45,72	14,67	81,40	49,63	9,67	77,96	49,60	9,67
	9	14	35,76	34,67	16,33	36,59	28,30	16,67	35,72	27,00	16,67
	10	14	60,87	21,37	17,17	54,66	22,58	9,25	53,57	22,14	9,25
	11	13	97,23	25,98	10,67	83,33	22,70	10,00	83,15	22,03	10,00
	12	13	27,18	22,12	23,83	24,84	20,68	24,33	25,17	20,10	24,33
	13	13	105,95	41,75	10,67	113,74	43,64	6,25	112,26	43,50	6,25

Note: TUG: Timed Up and Go Test; 5TSTS: 5-Time Sit-To-Stand Test; FRT: Functional Reach Test.

ARTIGO 2 - BRIEF COMMUNICATION

TABLE 1

Table 1 – Sample's characteristics.

Variables		Post-stroke individuals (n=25)
Age (years)		60.9 (55.70-66.13)
Sex (Male/Female)		18/7
Educational level	Basic education	5
	High school	4
	Higher Education	16
Time since stroke (months)		55 (35.51-74.48)
Stroke type (Ischemic/Hemorrhagic)		17/8
Affected side (Right/Left)		8/17
Mini-Mental State Examination		27.3 (26.12-28.43)
FMA-LL (Severe/Moderate)		13/12

Note: Data are expressed as frequencies, means, and standard deviations. FMA-LL: Fugl-Meyer Assessment - lower limb; n: number of participants.

TABLE 2

Table 2 - In-person *versus* tele-assessment.

Assessment	In-person	On-line synchronous	P-value	ICC (95% CI)
360TURN R (s)	11.97 (8.73-15.21)	12.78 (9.32-16.23)	**0.021***	0.99
360TURN R (steps)	11.82 (9.82-13.82)	11.99 (9.78-14.21)	0.422	0.98
360TURN L (s)	11.97 (8.72-15.23)	13.09 (9.56-16.61)	**0.028***	0.97
360TURN L (steps)	11.37 (9.67-13.07)	12.27 (10.12-14.42)	**0.039***	0.97

Note: 360TURN: 360 Degree Turn Test; R: right; L: left; s: seconds; ICC: Intraclass Correlation Coefficient; CI: confidence interval. Data are mean and confidence intervals.

TABLE 3

Table 3 - Intraclass correlation coefficient (ICC) for inter-rater and intra-rater reliability.

Assessment	Evaluator 1 (on-line synchronous)	Evaluator 1 (on-line asynchronous)	ICC (95% CI)	Evaluator 2 (on-line asynchronous)	ICC (95% CI)
360TURN R (s)	12.78 (9.32-16.23)	12.64 (9.25-16.03)	1.00 (1.00-1.00) [a]	12.73 (9.38-16.07)	1.00 (1.00-1.00) [b]
360TURN R (steps)	11.99 (9.78-14.21)	12.01 (9.78-14.23)	1.00 (1.00-1.00) [a]	11.98 (9.77-14.19)	1.00 (1.00-1.00) [b]
360TURN L (s)	13.09 (9.56-16.61)	13.13 (9.67-16.59)	1.00 (1.00-1.00) [a]	13.31 (9.76-16.86)	1.00 (1.00-1.00) [b]
360TURN L (steps)	12.27 (10.12-14.42)	12.25 (10.06-14.44)	1.00 (1.00-1.00) [a]	12.29 (10.07-14.52)	1.00 (0.99-1.00) [b]

Note: 360TURN: 360 Degree Turn Test; R: right; L: left; s: seconds; ICC: Intraclass Correlation Coefficient; CI: confidence interval;
a – intra-rater reliability; b – inter-rater reliability. Data are mean and confidence intervals.

SUPPLEMENTARY MATERIAL 1

Supplementary Material 1 - OMPEPE guideline.

360 Degree Turn Test	
O	We will administer this test, which is called 360 Degree Turn Test to evaluate your dynamic balance, which is your ability to maintain balance while moving.
M	This test does not require any materials.
P	To begin the test, you must be standing facing me with your legs comfortably apart and your arms relaxed.
E	When I give you the command, make a complete 360-degree turn around your own axis.
P	At the end of the test, your position should be facing me again.
E	The testing area must be clear of any obstacles or objects that could disrupt the test or draw your attention away.
Observation: We will perform the test three times for each side to ensure accuracy. You can use devices to aid during the test, such as crutches if necessary.	

5. CONCLUSÃO GERAL

Os achados deste estudo indicam que a teleavaliação é uma ferramenta confiável para avaliação de mobilidade e equilíbrio em indivíduos após AVC quando a avaliação online é planejada e realizada sistematicamente. Nossos resultados são dignos de nota pois a teleavaliação pode representar uma solução para monitorar pacientes após AVC e outros pacientes neurológicos quando os serviços de saúde presenciais são inviáveis. Além disso, a teleavaliação do *360 Degree Turn Test* é confiável e segura para avaliação do equilíbrio após AVC. Com base em nossos resultados, não recomendamos o uso de um método de avaliação misto que combine testes presenciais e online para o mesmo paciente tratando do *360 Degree Turn Test.*

Nossos resultados podem ter implicações importantes para o cuidado de pacientes após AVC e outros pacientes neurológicos. A teleavaliação pode representar uma ferramenta valiosa para monitorar a mobilidade e o equilíbrio de pacientes após AVC que enfrentam dificuldades no acesso a serviços de saúde presenciais. Os achados deste estudo também encorajam o desenvolvimento de diretrizes e protocolos de teleavaliação para outras condições de saúde, melhorando o acesso aos cuidados de pacientes com mobilidade limitada ou que vivem em áreas remotas.

6. IMPACTOS DO TRABALHO

Atualmente, o Acidente Vascular Cerebral é a doença neurológica que mais causa morte e incapacidade, sendo a segunda maior causa de morte no mundo. A má perfusão encefálica gera distúrbios sensório-motores, cognitivos e comportamentais, podendo reduzir a capacidade funcional dos indivíduos acometidos, limitando sua participação social e realização das atividades de vida diária. Assim, destaca-se a importância de métodos eficazes de avaliação da mobilidade e do equilíbrio de indivíduos pós AVC para melhor planejamento das estratégias de reabilitação e recuperação funcional dessa população.

Os resultados desta pesquisa indicam que a teleavaliação é uma ferramenta confiável para avaliação de mobilidade e equilíbrio em indivíduos após AVC quando a avaliação online é planejada e realizada sistematicamente. A teleavaliação pode representar uma solução para monitorar pacientes após AVC e outros pacientes neurológicos quando a avaliação presencial não é viável, melhorando o acesso aos cuidados de pacientes com mobilidade limitada ou que vivem em áreas remotas.

7. ANEXOS

ANEXO A: STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Pag e No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	
Objectives	3	State specific objectives, including any prespecified hypotheses	
Methods			
Study design	4	Present key elements of study design early in the paper	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	

Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	

Continued on next page

Results

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	

		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	
Generalisabilit y	21	Discuss the generalisability (external validity) of the study results	
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

ANEXO B: Parecer do Comitê de Ética em Pesquisa

UNIVERSIDADE FEDERAL DE CIÊNCIAS DA SAÚDE DE PORTO ALEGRE

Plataforma Brasil

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: TELE-AVALIAÇÃO APLICADA A INDIVÍDUOS PÓS ACIDENTE VASCULAR CEREBRAL: CONCORDÂNCIA E CONFIABILIDADE

Pesquisador: ALINE DE SOUZA PAGNUSSAT

Área Temática:

Versão: 2

CAAE: 45137321.5.0000.5345

Instituição Proponente: Universidade Federal de Ciências da Saúde de Porto Alegre

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 4.712.240

Apresentação do Projeto:

De acordo com o documento INFORMAÇÕES_BÁSICAS_DO_PROJETO_1726583, postado na Plataforma Brasil em 29/04/2021:

Resumo:

O acidente vascular cerebral (AVC) é uma doença cerebrovascular de alta incidência, mortalidade e morbidade no Brasil e no mundo. Os distúrbios
sensório-motores são as incapacidades mais comuns após o AVC, dificultando a realização das atividades de vida diária (AVDs) e impactando
diretamente na qualidade de vida dos indivíduos acometidos. Nesse sentido, ferramentas de avaliação confiáveis e eficazes são fundamentais para
melhor planejamento das estratégias de reabilitação.
Atualmente estão disponíveis alternativas como a tele-avaliação, recurso que facilita o acesso ao serviço. No entanto, são escassos estudos que
comprovem a confiabilidade do formato de avaliação à distância aplicado a essa população. Desse modo, os objetivos do presente estudo são: (a)
verificar a correlação da tele-avaliação com medidas instrumentadas clássicas para avaliação de parâmetros relacionados à mobilidade e ao
equilíbrio, em indivíduos após AVC; (b) verificar a confiabilidade intraexaminador e

UNIVERSIDADE FEDERAL DE CIÊNCIAS DA SAÚDE DE PORTO ALEGRE

Plataforma Brasil

Comentários e Considerações sobre a Pesquisa:

De acordo com o documento INFORMAÇÕES_BÁSICAS_DO_PROJETO_1726583, postado na Plataforma Brasil em 29/04/2021, trata-se de um estudo observacional transversal, com cronograma previsto para ser executado entre 06/2021 e 12/2022.

Considerações sobre os Termos de apresentação obrigatória:

Termos obrigatórios apresentados de forma adequada.

Recomendações:

Vide campo "Conclusões ou Pendências e Lista de Inadequações".

PS: Em tempos de pandemia COVID-19, caso haja necessidade de adequação da metodologia, cronograma entre outros, deverá ser encaminhada "emenda", dentro da vigência do projeto.

Conclusões ou Pendências e Lista de Inadequações:

A relatoria sugere que o projeto seja considerado aprovado.

Ressalta-se que cabe ao pesquisador responsável encaminhar os relatórios parciais e final da pesquisa, por meio da Plataforma Brasil, via notificação do tipo "relatório" para que sejam devidamente apreciadas no CEP, conforme Norma Operacional CNS nº 001/12, item XI.2.d.

Considerações Finais a critério do CEP:

De acordo com o parecer do Relator.

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_1726583.pdf	29/04/2021 21:45:46		Aceito
Outros	carta_resposta.docx	29/04/2021 21:44:40	ALINE DE SOUZA PAGNUSSAT	Aceito
TCLE / Termos de Assentimento / Justificativa de	termo_de_consentimento_versao2.docx	29/04/2021 21:43:42	ALINE DE SOUZA PAGNUSSAT	Aceito

Ausência	termo_de_consentimento_versao2.docx	29/04/2021 21:43:42	ALINE DE SOUZA PAGNUSSAT	Aceito
Projeto Detalhado / Brochura Investigador	projeto_de_pesquisa_versao2.docx	29/04/2021 21:42:57	ALINE DE SOUZA PAGNUSSAT	Aceito
Outros	termo_de_compromisso_relatorio.pdf	31/03/2021 20:51:22	ALINE DE SOUZA PAGNUSSAT	Aceito
Outros	termo_de_compromisso_dados.pdf	31/03/2021 20:49:50	ALINE DE SOUZA PAGNUSSAT	Aceito
Outros	termo_de_anuencia.pdf	31/03/2021 20:49:17	ALINE DE SOUZA PAGNUSSAT	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	termo_de_consentimento.docx	31/03/2021 20:48:35	ALINE DE SOUZA PAGNUSSAT	Aceito
Projeto Detalhado / Brochura Investigador	projeto_de_pesquisa.docx	31/03/2021 20:48:17	ALINE DE SOUZA PAGNUSSAT	Aceito
Folha de Rosto	folha_de_rosto.pdf	30/03/2021 18:35:24	ALINE DE SOUZA PAGNUSSAT	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

PORTO ALEGRE, 14 de Maio de 2021

Assinado por:
Fernanda Bordignon Nunes
(Coordenador(a))