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2024

Background

Range of motion (ROM) is defined as the measurement of movement around a particular joint or body component, which can be a technique or as an assessment tool. Restrictions in ROM can result from traumas like bone fractures or neurological illnesses like stroke. Physicians and physical therapists measure joint ROM for diagnosis, disease severity evaluation, and prognosis prediction.

ROM can be measured using a variety of equipment, including goniometers (universal and joint specific), inclinometers, tape measures, electrogoniometers, photography, video recording, and radiography. A goniometer is an instrument that can spin an object to a certain position or measure an angle. There are several varieties of goniometers utilised, including universal goniometers, digital goniometers, twin axis electrogoniometers, arthrodial goniometers, and gravity goniometers/inclinometers and smartphone goniometry application. According to Malaysian Medical Device Authority (MDA), goniometer / inclinometer /scoliometer are defined as 'posture evaluation instruments provide accurate and repeatable measurements.' There is strong interest in digital goniometer as it is easy to use, convenient, portable and minimum training required.1, 2 There is strong interest in digital goniometer as it is easy to use, convenient and portable.1 Majority healthcare facilities in Malaysia are using universal goniometer in measuring ROM.

The relative reliability and validity of the goniometer are often measured by intra-class correlation (ICC), concordance correlation coefficient (CCC) and Pearson's product moment correlation (r). On the other hand, the absolute reliability and validity measured based on standard error of measurement (SEM), minimal detectable change (MDC), mean difference (MD) and limits of agreement (LOA).

Objective

To assess the effectiveness, safety, and economic implication of digital goniometer.

Methods

Electronic databases were searched through the Ovid interface: Ovid MEDLINE and EBM Reviews - Cochrane Database of Systematic Reviews 2005 to 19th January 2024, EBM Reviews - Cochrane Central Registered of Controlled Trials January 2023, EBM Reviews - Database of Abstracts of Review of Effects 1st Quarter 2016, EBM Reviews - NHS Economic Evaluation Database 1st Quarter 2016. PubMed, US FDA, INAHTA and general database such as Google Scholar were used to search for additional web-based materials and information. Additional articles retrieved from reviewing the bibliographies of retrieved articles. The search was limited to articles on human. There was no language limitation in the search. The last search was conducted on 18th March 2024.

Results and conclusion:

A total of 11 records were identified through the Ovid interface and PubMed, and 51 records identified from other websites. Seven duplicates' references were found; 55 potentially relevant titles were screened using the inclusion and exclusion criteria. Of these, 40 relevant abstract was retrieved in full text. After reading, appraising and applying the inclusion and exclusion criteria to the 40 full text articles, 9 were included. Those were excluded as those primary studies were

already included in systematic review (n=5), irrelevant study design (n=4), not relevant to DG (n=10), review articles (n=2) and funding bias (n=1). A total of nine full text articles were finally included in this review comprised of one systematic review, one prospective cohort study and seven cross-sectional studies.

Efficacy/ effectiveness

In general, evidence demonstrated that most of the studies identified that digital goniometer or smartphone goniometry application demonstrated between good to excellent inter- and intra-rater reliability with other types of goniometers for variety of joints studied. Evidence demonstrated that the device has good validity against other types of goniometers.

Safety

There was no study retrieved related to the safety of the digital goniometer or smartphone goniometry application. Malaysian Medical Device Authority (MDA) requires the registration of goniometer for Malaysian market. US FDA classified goniometer as Class I and Class II device which are exempted from the pre-market notification.

Organisational

With sufficient training and familiarisation, handling of goniometer can be handled by new assessor.

Economic implication

There was no evidence retrieved on the cost-effectiveness or other economic analysis related to digital goniometer or smartphone goniometry application. The estimated price for [redacted] digital goniometer is [redacted] and the smartphone goniometry application can be in between [redacted].

Conclusion

Universal goniometer, digital goniometer and smartphone goniometry application demonstrated good to excellent performance for measuring joint ROM except for cervical joint. No safety issue reported and no major economic implication.