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Technology and Innovation Project - Cervical Range of Motion Digital – (Crom- D) Device for Assessing The Range of Motion of The Cervical Spine

Camila Vitória De Moraes Costa; Ilder Anne Souza Bezerra; Geovanna Cristina Pereira Alves; Thayllane Costa Cardoso; Madson Cruz Machado; José Francisco Dos Santos Júnior; Almir Dibai-Filho; Maria Claudia Gonçalves

Universidade Ceuma, São Luís - Ma - Brazil.

Introduction
The assessment of cervical spine range of motion (ROM) is more complex due to the associated movements of the upper thoracic spine. However, this measurement provides crucial information for diagnosing musculoskeletal dysfunctions, analyzing disease progression, evaluating the effects of different treatments, and monitoring patient progress during rehabilitation. Radiography, considered the gold standard, is costly and exposes individuals to radiation. Goniometers and inclinometers lack good intra- and inter-examiner reproducibility. Currently, the most reliable and secure instrument available is the Cervical Range of Motion (CROM) device, but due to its importation, it comes with a high cost and is difficult to acquire.

Objective
To develop a digital and user-friendly instrument for assessing ROM in flexion, extension, lateral flexion, and rotation of the cervical spine. MATERIALS AND

Methods
We developed an MPU6050 sensor with an Organic Light Emitting Diode (OLED) display, an Arduino with a power source, connection cables, and a 5-volt power supply. This setup measures and maintains orientation and angular velocity during cervical spine ROM assessment. It was constructed with a three-axis accelerometer and gyroscope (X, Y, and Z).

Results And Discussion
In initial tests, the device proved effective in evaluating all four measures of cervical ROM (flexion, extension, lateral flexion, and rotation) without the need to change the device or reposition the patient. It provides ROM angles from 0 to 120 degrees, does not exhibit parallax error, and, being digital, is not subject to observer measurement errors. Experimental tests are currently being conducted to adapt the device into a plastic headpiece prototype that can record ROM in all planes without the need for anatomical markings or device repositioning during the entire assessment. This prototype aims to provide safety and prevent device displacement during evaluations.

Conclusion
The CROM-D device for assessing cervical ROM has been developed, demonstrating easy usability and accuracy in preliminary tests. Future research will focus on assessing the reliability and validity of this instrument compared to the gold standard for cervical ROM evaluation.

Keywords: Cervical spine; CROM; assessment.