A literature review of the benefits and limits of affordable measure devices in biomechanical and biophysics courses -- Perspectives for osteopathic education and research.

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Introduction

Biomechanics has introduced as an official teaching unit in the education of osteopathic students since 2014 (Décret n° 2014-1505 du 12 décembre 2014 relatif à la formation en ostéopathie, 2014). Beyond the fundamental knowledge provided by this discipline, the objective is to give students a critical scientific look on the tests and the different osteopathic approaches taught at the institute. However, biomechanics could sometimes be hard to apprehend for students and it is often summarized to calculus. Last decades, with the development of smartphone and new video game remote, there is plenty of affordable measure devices for movement and posture analysis.

Introduction of these tools in osteopathic education has two goals, facilitate the comprehension of biomechanics laws/applications to make it more "touchable" and warn student about these tools and their limits.

For example, the Wii Balance Board is reliable for clinical study and we use it to introduce student to measure of the Center of Pressure (CoP) during a posture analysis [1]. Its wireless connection and the existence of software like Tekilibre or Squatphy, allow us to use it in an educational and clinical goal.

In addition, applications for goniometry based on smartphone's inertial sensor and on the camera for performance recording are reliable and valid with good reproducibility (ICC > 0.75) [2]. Some freeware like *Kinovea* represents a reliable motion analysis software [3] to compute biomechanical parameters (position, velocity) for shoulder motion for example (ICC inter-rater = [0.95-0.98] and ICC intra-rater= [0.98-0.99] for shoulder motion i.e.). The acquisition frequency of the camera conditions the quality of

the measure. Kinovea propounds a few automatic features to track label path. It versatility provides us an opportunity to measure speed, acceleration, range of motion and also in specific cases stiffness of lower limb.

All the features introduce objective measures to our students and open the problematic of clinical relevance of the measure. There are some limits and it is also a part of the lesson to understand the right use of affordable device and smartphone application (for example multiple drops on the smartphone which damage the inertial sensor, picture resolution, and sometimes algorithm of the application skew the result and cause bad clinical decision). The challenge is also to educate future osteopaths in the use of objective tools to evaluate their treatments in order to promote research in osteopathy.

Sources:

[1] Clarck RA, et al., Reliability and validity of the Wii Balance Board for assessment of standing balance: A systematic review. Gait Posture. 2018 Mar; 61:40-54.

[2] Keogh JWL, et al, Reliability and validity of clinically accessible smartphone applications to measure joint range of motion: A systematic review, 2019;14(5):e0215806.

[3] Abd Elrahim RM, Embaby EA, Ali MF, Kamel RM. Inter-rater and intra-rater reliability of Kinovea software for measurement of shoulder range of motion. Bull Fac Phys Ther 2016; 21:80-7