Applications of Virtual Reality in Osteopathic Medical Student Education

Anthony J. Perugini III[1,2]; Sergej Stjepic[1,2]; Bradley J. Boget[1,2]; Garren P. Gebhardt, DO, MS[2,3]; David L. Dufeau, PhD[1,2]

[1]3D Visualization Laboratory, Marian University College of Osteopathic Medicine, Indianapolis, IN, USA; [2]Marian University College of Osteopathic Medicine, Indianapolis, IN, USA; [3]Department of Clinical Affairs, Marian University College of Osteopathic Medicine, Indianapolis, IN, USA;

BACKGROUND

Book, presentation, and video are the current most popular modalities used for grasping what is conceptual in OMM; Students entering medical school have a higher degree of technological literacy. Education technology reports have indicated that the current generation of students has shown great interest in interactive technology and web applications (apps)[1]. Subsequently the "gamification" of education has quickly shown promise[2]. These "games", virtual reality (VR), and augmented reality (AR) simulations have been shown to promote learning, engagement, clinical application, and immediate feedback to the student[3,4]. Integrative virtual reality and simulation based education is readily embraced as a standard for specialties such as surgery, urology, cardiology, basic procedural education, and more[5].

We postulate that a movement towards a dynamic, three-dimensional application, or website, that animates the techniques of OMM could be a highly beneficial development. The goal of this proof-of-concept is to posit how we can come to understand whether technologies such as VR can be developed and integrated, and how their effects on osteopathic students can be measured. In order to achieve this goal we have developed a proof of concept technology at Marian University College of Osteopathic Medicine (MUCOM) that models a number of basic dysfunctions, and that would be VR compatible.

MATERIALS & METHODS

Creating the Models

These data for creating the anatomical simulations were sourced from an anonymized medical scan. The data used in this study are in the format of a Computerized Tomography (CT) imaging study. CT scans were uploaded to the Amira data analysis package (F.E.I. Amira v. 6.0.0) which was used to analyze volumetric data sets. These data were analyzed and interpolated (slice-by-slice) to render individual three-dimensional bones and muscles. These data were used to construct educational simulations of kinetic three-dimensional (3-D) movements.

Narrated simulations were implemented as hyperlinks on a static human skeletal model. The narrated simulations were constructed and animated from volumetric data rendered on Amira (**Figure 1**). The rendered 3D objects were transferred from the Amira volume analysis software to the Camtasia video editor (Mac Version 2.10.8) (**Figure 2**). Camtasia is a video editing software that was used to narrate, record, edit, and aid in the production of the final instructional videos that were the addendum to the original silent simulations. These simulations are viewable as interactive simulations on the Sketchfab online forum at the following address: https://skfb.ly/6O6tL. Sketchfab is an open online forum that allows creators of three-dimensional simulations to upload their work unto its platform for public access. Sketchfab, allows educational and artistic models to be viewed and downloaded at the discretion of the creator of the simulated models (**Figure 3**).

CT SCANS & SIMULATION PRODUCTION

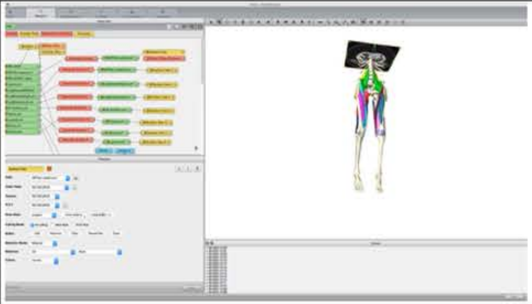

Figure 1. Amira Data Analysis Package (F.E.I. Amira v 6.0.0) analyzing deidentified computerized tomography data to render 3D bones, tendons, and muscles.

Figure 2. Camtasia Video Editor (Mac Version 2.10.08) editing software used to narrate, edit, and record the production of finalized instructional videos as addendum to simulation.

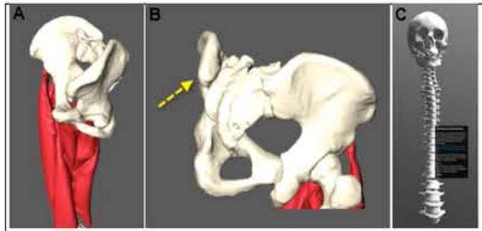

Figure 3. Sketchfab Online Open Source Forum; Visualization of 3D simulations.
3A – Emphasis on musculoskeletal anatomic position
3B – Anatomic Landmarks relevant to musculoskeletal pathology
3C – Referenced Information Pockets / Drop Down for a given somatic dysfunction

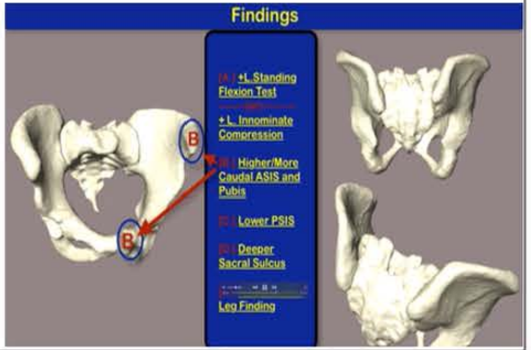

Figure 4. Sketchfab Interface; Example of Posterior Innominate Somatic Dysfunction.

Physical Exam findings (with respect to R side):

- Positive Standing Flection Test
- Innominate Compression Test,
- Higher ASIS
- Higher Pubis
- Lower PSIS
- Deeper Sacral sulcus,
- Superior medial malleolus

PILOT STUDY

- Double-blinded case versus control study of incoming OMS-1
- Participants asked via survey for willingness to participate
- Total number of students not exceeding 30 (n = 30)
- Students divided into two cohorts receiving either:
  - Simulations of Type I & II Fryette Somatic Dysfunctions
  - Standard 50 minute Didactic Lecture on Type I & II Fryette Somatic Dysfunctions
- All Students take 30 Q Exam administered via Ipad
- All Students go down to OMM Lab and asked to diagnose and treat a Fryette Type I or II Somatic Dysfunction previously diagnosed by Osteopathic Physician and faculty of MU-COM
- Students graded by same blinded faculty member using standard set criteria for MUCOM osteopathic physical exams and treatment.

REFERENCES

1. McCoy L, Pettit RK, Lewis JH, et al. Developing Technology-Enhanced Active Learning for Medical Education: Challenges, Solutions, and Future Directions. *JAOA*
2. McCoy L, Lewis JH, Dalton D. Gamification and Multimedia for Medical Education: A Landscape Review. The Journal of the American Osteopathic Association. 2016;116(1):22-34.
3. Akl EA, Pretorius RW, Sackett K, et al. The effect of educational games on medical students' learning outcomes: a systematic review: BEME Guide No 14. Med Teach. 2010;32(1):16-27.
4. Kron FW, Gjerde CL, Sen A, Fetters MD. Medical student attitudes toward video games and related new media technologies in medical education. BMC Medical Education. 2010;10(1):50.
5. Shamim Khan M, Ahmed K Fau - Gavazzi A, Gavazzi A Fau - Gohil R, et al. Development and implementation of centralized simulation training: evaluation of feasibility, acceptability and construct validity. (1464-410X (Electronic)).