

Keywords: Dirofilaris, Zoonotic, PCR, Gel Electrophoresis, Sequencing
A Review on Synthesizing Data for Virtual Patient Simulators in Dentistry

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It is often observed that students in dentistry have limited opportunities to enhance clinical skills during their academic programs due to limitations in human resources and facilities. Alternatively, Virtual Patient Simulators (VPS) have been investigated to train on investigations and procedures. Thus, designing precise patient cases for simulation, and ensuring realism for users is vital in dentistry. Hence, this review investigates data synthesis methods for VPS systems. The literature and the existing databases were reviewed using PubMed from 2000 to 2023 for the studies reporting VP creation for dentistry. Full manuscripts were included, and data were abstracted based on methods used to collect input data, 3D models created, simulator feed format, and the type of skill/s training achieved. Out of the 287 titles retrieved, 40 full articles were selected. In the process of VP development, 3D models of anatomical structures such as teeth, mouth, jaw, mandible, face, skull, etc., were constructed using software packages including 3Dslicer software, Mimics Medical software 24.0, etc. These models were generated from radiological images (CBCT, CT, or panoramic images) or scanned images of actual patients or dental models. The 3D data from these models were typically converted to STL (Stereolithography Tessellation Language) format before input into the simulators. Usage-wise, most VPS were targeted on skills in orthognathic surgeries, tooth preparations, and cavity preparation in Restorative dentistry. Future studies focus on assessing the accuracy and the validity of the synthesized data depending on the steps followed during VP model creation.

Keywords: Virtual Patient Simulators, Skill Training, Dentistry, Data Synthesis, Data Format