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Applicability of Stereophotogrammetry System in Pediatric Dentistry

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Abstract

Pediatric Dentistry is one of the specialties in dentistry that aims to diagnose, plan, treat, and clinically monitor the oral health of children from birth onwards. However, a detailed analysis of the craniofacial complex is not always possible using two-dimensional scans, which is why it is necessary to apply three-dimensional technologies that can provide the pediatric dentist with detailed and accurate information about the patient. Among these resources, the stereophotogrammetry system is a viable option since it is quick to use, does not emit ionizing radiation, and allows detailed anthropometric analyses. The purpose of this short commentary is therefore to present the applications of the stereophotogrammetry system in children and discuss the system's advantages and limitations.

Keywords: Face; Dental cast; Photogrammetry; Anthropometry; Imaging; Three-dimensional; Pediatric dentistry.

Short commentary

Pediatric dentistry is one of the specialties of dentistry, which is responsible for looking after the oral health of children from birth to adolescence. Therefore, the professional must have in-depth documentation with all the necessary patient data to enable a correct diagnosis, treatment planning, and clinical follow-up [1]. This documentation is based on anamnesis, clinical examinations, and complementary tests. Conventional complementary exams include radiographs, photographs, and dental plaster models [1]. However, craniofacial analysis using two-dimensional complementary exams (photographs and radiographs) is not always easy to analyze, as these are complex anatomical structures; the use of three-dimensional (3D) technology is therefore a reality in clinical practice and has become a convenient method to apply [2-4].

3D technology has brought about a significant change in both the capture and analysis of images, and among the equipment used is the stereophotogrammetry system [5]. This optical instrument is made up of one or more photographic cameras (fixed or portable) that allow you to capture images from different angles and specific software renders a 3D digital image [6]. In pediatric dentistry, this approach has been used to digitize plaster dental models [2,7] and facial scans [8,9] for subsequent quantitative and qualitative anthropometric analysis of the craniofacial complex using software [10,11]. Currently, the stereophotogrammetry system makes it possible to carry out quantitative analyses such as linear and angular measurements, perimeter, surface area, volume, and image superimposition. These resources were applied to children with and without craniofacial anomalies, both in facial analysis [5,8,12,13] and in the

evaluation of digitized dental models [2,7,10,11].

Stereophotogrammetry is a non-invasive, non-ionizing method that does not require physical contact between the equipment and the patient/dental model, and allows images to be acquired quickly (2 milliseconds) [6]; this feature makes it easier to apply in the diagnosis and planning of clinical cases in children from birth. In addition to these benefits, the use of 3D technology contributes to sustainability by not producing waste that is harmful to the environment. Other advantages of using 3D images include the absence of degradation of complementary exams, a reduction in physical space for storing documentation [7], the creation of a database that can be integrated into the patient's electronic health record, the possibility of planning clinical cases between professionals working in different institutions [7], the possibility of making a digital back-up of data and, finally, a quick and accurate assessment of craniofacial anthropometry [14].

Several studies have compared anthropometry on the face and on dental models in three-dimensional images, and the portable and fixed stereophotogrammetry system showed good reproducibility, precision, and accuracy, proving the system's validation [2,4,6,7,14,15], which for not only the pediatric dentist, but for other professionals who use this resource, is a very important issue that indicates the safety of the data obtained and analyzed by this resource, which directly influences diagnosis, planning, and clinical follow-up. For the study of craniofacial development and growth, the anatomical landmarks can be defined directly on the digitized face [14]. However, one approach that has often been used is to mark the anatomical landmarks on the face with a makeup eyeliner before capturing the images [5]. Some authors argue that this practice can contribute to digital analysis, especially in anatomical regions that need to be palpated in order to be marked, such as the orbital point [5].

Some of the limitations of using this system relate to the cost of the system, which is not always affordable for professionals [14,16], as in addition to purchasing the system, it is also necessary to buy a high-performance computer or notebook. These devices are designed to perform tasks that require a lot of processing power, such as complex simulations, large-scale data analysis and 3D image rendering. Another limiting factor is the lack of expertise in the analysis of non-ionizing 3D images on the part of professionals, since, to date, there are few undergraduate courses or postgraduate courses in digital dentistry to contribute to dentists' training. Finally, another relevant criterion is that, in order to carry out facial scanning on children up to 36 months old, adaptations are sometimes necessary, as it is not always possible to follow the manufacturer's guidelines; therefore, the help of the parents/legal guardians accompanying the child is necessary, so that the child can remain calm during the capture of the images, without influencing the facial expression, which must remain neutral, in addition to the child's own positioning in relation to the image captures. Another point, distraction devices such as toys or children's videos can also be used to help during image capture [17].

Thus, the use of stereophotogrammetry system in pediatric dentistry should be considered a highly relevant technological resource, since, in addition to having several advantages, such as the rapid acquisition of non-ionizing images, it also enables integration into a database, facilitating diagnosis, clinical case planning, as well as monitoring the development and craniofacial growth of children from birth to adolescence.

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