Research Article

Clinical Protocol for Intraoral Scanning of Children in Early Childhood

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Abstract

Intraoral scanning is a non-invasive procedure that uses three-dimensional scanning technology to create a digital image of the oral cavity. Thus, this study aimed to define the protocol for intraoral scanning in children in early childhood. Twenty children participated in the study. Children up to 36 months were scanned in the knee-to-knee position, while children aged 37 to 72 months were scanned on the dental chair. It is concluded that intraoral scanning in early childhood is feasible and should be conducted by a skilled operator adept in the technique.

Keywords: Child Preschool; Dental Arch; Imaging Three-Dimensional; Pediatric Dentistry

Introduction

Intraoral digital scanning has proven to be a promising tool for diagnosing and planning dental treatments in various age groups. In addition to providing numerous possibilities for improving clinical practices, making them more efficient, precise and less invasive, this technique replaces the discomfort of traditional impressions with a portable and highly accurate device, intraoral scanners [1-4].

In scientific literature, pediatric dentistry has been using intraoral scanning in children with and without cleft lip and palate for planning and digital workflow in clinical cases of incisor molar hypomineralization, diagnosis of carious lesions, preparation of space maintainers and especially for monitoring the individual's craniofacial development and growth [2-8]. Although authors have published articles on intraoral scanning in children few studies have focused on the age group between the first months of life and 6 years of age, resulting in a knowledge gap about the feasibility of the scanning protocol in children [2-9].

As a result, intraoral scanning in children in this age group presents unique challenges due to cooperative immaturity, developing oral anatomy and difficulties in adapting to the procedure. Therefore, this study aimed to describe a protocol for intraoral digital scanning in children in early childhood.

Method

This clinical protocol for scanning in children was approved by the Institutional Review Board. Before the scan was performed, the guardians of all participants were invited to participate in the study and after agreeing, they signed a Free and Clarified Consent Form to authorize the child's participation.

Intraoral Scanning Protocol

The Virtuo Vivo™ intraoral scanner (Straumann®, Montreal, QC, Canada) was used coupled to a notebook (Avell C62 RTX LIV-Smilik by Virtuo Vivo edition, Joinville, SC, Brazil). This scanner was chosen because its tip is the smallest and lightest on the market, facilitating scanning in children from the first months of life.

Participants up to 36 Months of Age

For this age group, the knee-to-knee technique was adopted [10] (Fig. 1). As babies are usually not body conscious, the guardian must help in the active protective stabilization of the child. If possible, an assistant can stabilize the patient's head. In this way, it was possible to perform the scan more fluidly and with the least possible discomfort for the child. The average scanning time was 3 minutes.

Participants Over 36 Months of Age

First, the child was explained what would be done and shown how the intraoral scan works. The child was positioned supine on the dental chair to perform the scan efficiently and maintain proper ergonomics. The operator took a position either behind the chair (at the 11 o'clock position) or beside it (at the 9 o'clock position) (Fig. 2).
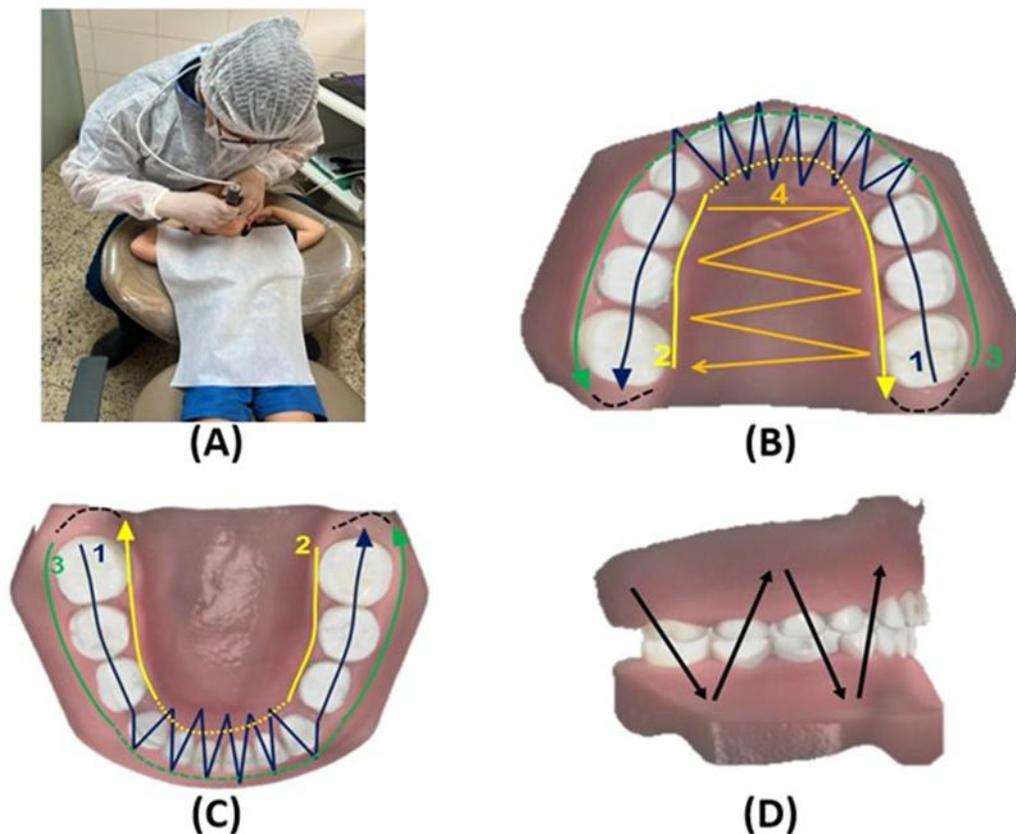
Intraoral Scanning Technique

Two pediatric dentists with experience in intraoral scanning conducted this procedure on the children. The technique was applied to children aged from 0 to 72 months. The scanning strategy of the upper dental arch began at the alveolar ridge, in the region of the tuber (occlusal face) on one side, followed by the alveolar ridge (blue line 1) to the tuber on the opposite side. The tip was placed on the palatal surface and continued to the opposite side (yellow line 2). Next, the tip was positioned on the buccal cortical bone of the ridge, passing from one side to the other (green line 3). To complete the palatal scan, "zigzag" movements were performed in the anatomical region that extends from the transverse palatal folds to the limit between the hard and soft palate (orange line 4) (Fig. 1).
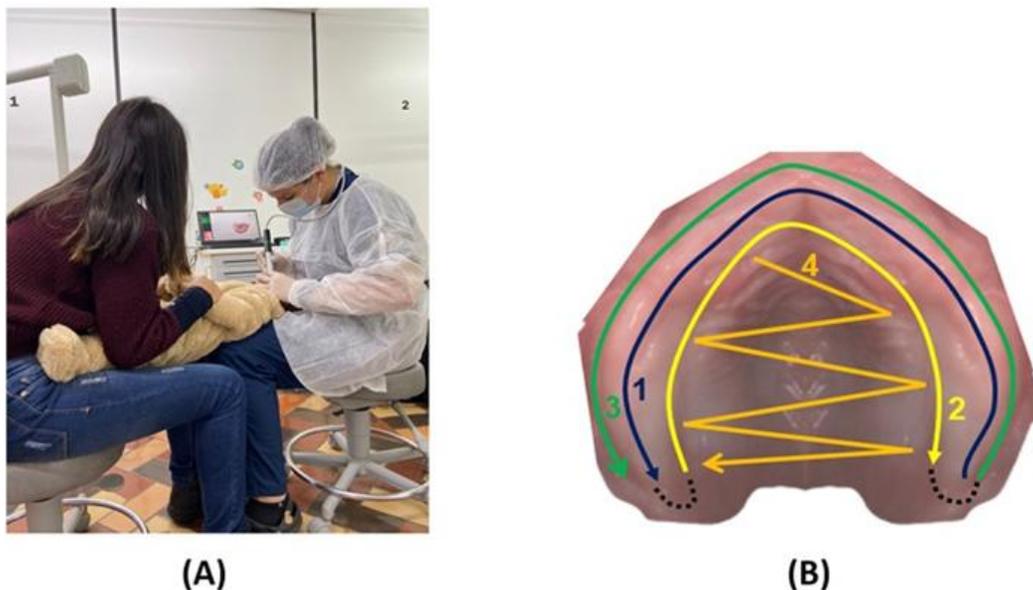
Figure 1: Intraoral scan of the upper dental arch of a child up to 36 months. A) Position of the child and the operator; B) Scanning technique (The arch scanning sequence goes from 1 to 4).

For children over 36 months of age, intraoral scanning of the upper dental arch began on the occlusal surface of the posterior teeth. In the anterior teeth region, the scanner tip moved across the lingual, incisal and buccal surfaces before continuing along the occlusal surface on the opposite side (blue line 1). Then, the 2nd stage consisted of scanning the palatine surfaces of the molars (yellow line 2). The same scanning procedure was performed on the buccal surface (green line 3). Finally, the image of the palate was finalized using "zigzag" movements in the region extending from the transverse palatal folds to the limit between the hard and soft palate (orange line 4) (Fig. 2).

In the mandible, a technique similar to that of the upper arch was performed, but the 4th stage of the scan ("zigzag" movement) was not performed (Fig. 2). Therefore, occlusal registration was conducted, in which the child was asked to remain with the teeth in occlusion. Then, the scanning tip was positioned in the molar region and the movement was made from the bottom of the sulcus of the maxillary molars to the bottom of the sulcus of the mandibular molars, extending to the canine region. This procedure was performed on both sides (Fig. 2).

Figure 2: Intraoral scan of dental arches in children over 36 months. A) Position of the child and the operator; B) Scanning technique of the upper dental arch; C) Lower dental arch scanning technique. D) Occlusion scanning technique.

Results

Twenty dental arches corresponding to 20 participants were scanned. Eleven females and nine males, with a mean age of 40.65 months, were scanned. Twelve children were between 7 and 36 months old, while 8 participants were between 37 and 72 months old.

Discussion

Intraoral scanning is a well-established practice in contemporary dentistry. It has been widely used in oral rehabilitation and has recently gained popularity in pediatric dentistry [1]. Digital dental models can be used to obtain clinical documentation of the child and as a complementary diagnostic examination that can assist in monitoring the development of dentition and occlusion [10]. This technique enables rapid three-dimensional acquisition of the dental arches. It also offers a more comfortable procedure for patients, particularly children, whose behavior can significantly impact the outcome of dental treatment [1]. In addition, the operator must have prior knowledge and mastery of the technique to make the procedure more efficient [9].

The time of the scanning procedure can vary according to the operator's skill, cooperation and the child's age. In the present study, the tell-show-do technique, known for its effectiveness in non-pharmacological management in pediatric dentistry, was employed before all scans [11]. It was used with children over 36 months to help them feel more secure during the procedure and ensure they cooperated for as long as possible [11,12].

The participant's position during the procedure varied based on the child's age and the comfort of the professional performing the scan. The "knee-to-knee" technique, widely used in pediatric care and field research, offers several advantages. It ensures the baby always maintains contact with the caregiver, providing greater calm and confidence. Additionally, it allows for greater stability of the patient's head, as the caregiver can restrain the baby's hands and feet, enabling the professional to scan more quickly and accurately [13]. In children over 36 months, the 11 o'clock position was used because in this position, the operator is behind the patient's head and therefore, it is easier to manipulate the scanner tip, in which the scan is performed faster and more accurately.

The primary challenge for children up to 36 months was keeping their mouths open. To address this, the operator placed their index finger behind the tuber, ensuring the mouth remained open, thus facilitating a more effective scan. In this sample group, the participants were a little agitated and scanning was a little more difficult, which is related to the children's young age and cognitive maturity. In preschool children, the main difficulty was scanning the lower dental arch due to excessive salivary flow. The operator had to continuously remove excess saliva to ensure the procedure could be done satisfactorily. For this age group, the children were curious during the procedure and there were no behavioral problems.

The professional needs to assess the frequency of dental arch molding in the office because although there are several intraoral scanning systems, the costs of this acquisition tend to be higher when compared to obtaining dental models in plaster [14]. Some authors who made this comparison indicated that after almost 4 years of clinical use, the costs between conventional molding and digital molding became equal [15], while others indicated that the scanning system can pay for itself in 2 years of use [16]. The variation in cost equalization can be explained by factors such as the brands of the intraoral scanning system, molding materials, plaster and trays, as well as the variation in costs between countries [15].

Furthermore, this study highlighted those participants who had previously undergone conventional alginate impressions found intraoral scanning more comfortable, which agrees with other authors [15]. Other participants showed interest in the procedure, as it allowed them to visualize their teeth on the notebook screen, making it well-accepted by children. This demonstrates that intraoral scanning, when performed by an experienced operator in pediatric dentistry, makes planning and treatments faster and more effective, positively influencing the child's behavior.

Conclusion
It is concluded that intraoral scanning in early childhood is feasible and should be conducted by a skilled operator adept in the technique.

Conflict of Interest
The authors declare that they have no conflicts of interest with the contents of the article.

Ethical Statement
This clinical protocol for scanning in children was approved by the Institutional Review Board (CAAE: 59705922.1.0000.5417 and CAAE: 59705922.1.3001.5441).

Informed Consent Statement
Informed consent was obtained from the participant involved in this study.

Authors' Contributions
All authors have contributed equally to this work and have reviewed and approved the final manuscript for publication.

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