




Article

Validated Questionnaire on Intraoral Scanner Effectiveness in Paediatric Patients

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Abstract: The intraoral scanner represents an important innovation in the world of dentistry, capable of transforming and digitizing conventional workflows and significantly improving communication with the patient, especially in pediatric age. The aim of this study is to investigate how digital dentistry, using the intraoral scanner, can interact in the communicative trinomial dentist–pediatric patient–parents and how this tool can be useful in communicating and understanding the received message. The value of the introduction of digital dentistry on communication schemes is evaluated by administering a questionnaire of 17 questions. A sample of 100 children aged between 6 and 12 years was studied. Of the sample of children/parents included in the study, 50 were re-examined 4 weeks after the first visit to re-administer the questionnaire. Internal consistency, assessed through Cronbach's alpha, was adequate, being alpha equal to 0.728. Test–retest reliability was assessed with Cohen's kappa index for dichotomous variables (percentage of agreement was >85.71%), and for the discrete variables it was assessed with the Intraclass Correlation Coefficient (ICC). The reliability was moderate ($0.5 < ICC < 0.75$) for Q4, Q9, Q11 and Q1; for the other answers, the reliability was poor ($ICC < 0.5$) and not statistically significant. The digital approach is confirmed not only as a powerful innovation from an engineering or clinical point of view, but also as a useful tool for a more effective communication in the approach to pediatric patients.

Keywords: intraoral scanner; pediatric dentistry; questionnaire



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1. Introduction

In recent years, the world of dentistry has undergone radical changes thanks to the introduction of digital technology into clinical activity. Among the positive contributions that this progress offers to patients is greater comfort in terms of speed, efficiency and safety [1]. The intraoral scanner is an important innovation in the world of dentistry, able to transform and digitize conventional workflows. The 3D scanner projects a light source (structured light or laser) onto the surface of the object to be analyzed, which, with the help of several micro cameras, captures the deformation of the object and reconstructs it as a virtual model directly on the screen [2] without the use of conventional impression materials. The intraoral scanner used in this study will be iterated; this restorative scanner (Align Technologies, San Jose, CA, USA) is the only intraoral digital scanner that uses

parallel confocal imaging technology and “point-and-stitch” reconstruction to generate precise and dust-free fingerprints. The images are accessible for observation to the dental unit in 2 min of intraoral scanning; they can then be sent to Align technology via the Internet, where they are converted into STL files and made accessible for download within 48 h [3]. The advantages of using the intraoral scanner are numerous: superior patient comfort, ease of use for the clinician, immediate verification of the recording quality of three-dimensional images of dental arcades, the speed with which they can be sent to the laboratory [4] and a significant improvement in dental communication with the patient, resulting in increased patient compliance.

Optical impression is a powerful tool for patient communication and marketing. In fact, with optical impressions, patients feel more involved in their treatment and it is possible to establish more effective communication with them; this emotional involvement may have a positive impact on the overall treatment, for example, by improving patient compliance to oral hygiene. In addition, patients are interested in the technology and mention it to their acquaintances and friends, raising their consideration of dental centers equipped with these modern technologies. Indirectly, IOS has become a very powerful advertising and marketing tool [5].

By “communication”, we mean all those procedures, both verbal and non-verbal, in which the operator, through their skills and the help of precise tools, in a personalized manner, is able to transmit information concerning the patient’s state of health so that they will understand all the indications received [1]. Ineffective communication will be the primary cause of errors and non-cooperation [6]; effective communication, on the other hand, will allow us not only to convey a message but also to safely manage patients with particular needs. In the case of an adult patient, we are faced with a communicative “binomial”, in which only the operator and the subject under treatment will exist [7]. The following study will focus on the pediatric patient, who, unlike the adult, will follow a different communication pattern involving three participants: the operator, the patient and the patient’s parents [8]. By virtue of this three-way communication, the operator must take a further step that will lead the communication strategy to branch in two directions: the first will be towards the pediatric patient and the second towards the parents who will play a fundamental role in the success and acceptance of the proposed treatment to the small patient. For successful medical treatment, it will be essential that the child, but also the adult, feel comfortable, and that they are in a position to receive the indications from the dentist and orthodontist [9]. The purpose of this study will be to investigate how digital dentistry, through the use of the intraoral scanner, can interact in the communicative trinomial dentist–pediatric patient–parents and how this tool can be useful in communicating and understanding the received message. The value of the introduction of digital dentistry on communication schemes will be evaluated by administering a questionnaire of 17 questions divided into two sections, one dedicated to the young patient and the other to the parent.

2. Materials and Methods

A cross-sectional observational study was conducted on an examined population of 100 children aged between 6 and 12 years who have a knowledge of the Italian language that allowed them to easily understand and answer the questions proposed in the questionnaire. The study was conducted at the Dental Clinic of the Department of Pediatric Dentistry of the University of L’Aquila (Abruzzo, Italy). The study included participants between 6 and 12 year old children who were having their first visit to the Department of Pediatric Dentistry of the University of L’Aquila, regardless of their state of dental health or having previously received dental treatment. On the contrary, patients who demonstrated (themselves or their parents) evident critical issues in understanding the Italian language, those who psychologically were not able to answer the questions of the questionnaire given to them or patients who were not sufficiently cooperative to be scanned for dental arcades were excluded from the study, as they would not have allowed a correct analysis of the results on account of not being able to properly understand the questions administered.

Patients whose parents did not consent to their participation in the study and that of their children were also excluded (Table 1).

Table 1. Study inclusion and exclusion criteria.

| Inclusion Criteria | Exclusion Criteria |
|-----------------------------|---|
| Ages between 6 and 12 years | Critical issues in understanding the Italian language |
| Any state of dental health | Patients psychologically–intellectually unable to answer the questions in the questionnaire |
| | Uncooperative patients |
| | Informed consent not accepted |

The questionnaire was, therefore, administered to all children and parents who ordinarily attended the pediatric dental clinic university headquarters of our study (those who will meet the criteria of inclusion), within the established time frame, by a dedicated researcher. A few minutes before taking the questionnaire, a second researcher had carried out the examination in the mouth with the scan of the dental arches. The completion phase of the test was performed in the waiting room by distributing the questionnaire to the present parent and explaining the content of each question. As for children, the same researcher who administered the questionnaire to parents filled in the questionnaire by recording the answers to the questions. The question was read to the child by the researcher; the child reported a verbal response noted by the same researcher on the questionnaire. At all stages of compilation, the parent was not able to help their child in the response. Of the sample of children/parents employed for the study, 50 were re-examined 4 weeks after the first visit to re-administer the questionnaire in order to carry out the questionnaire reliability test, using the same researcher used for the first administration. The study was carried out in order to satisfy the following research questions:

- Whether and to what extent the use of the scanner will facilitate the parent’s understanding of the oral state of health of the child.
- Whether and to what extent the use of the scanner will facilitate communication between the dentist and the parents [10],
- If the dental records facilitated by the scanner will be better tolerated and more suitable for the child than the traditional dental records [11].

The administered questionnaire (Figure 1) included 17 questions, of which the first 11 were addressed to the parent and the last 6 were reserved for pediatric patients. Both parties responded only after the conclusion of the first visit in which the dental scan was made. The questions have two different types of answers: the first gives the subject the opportunity to provide a binary answer (yes or no), the second divides into a scale of ten values (0 to 10), indicating the intensity of the phenomenon. The questionnaire was created in Italian and administered to all patients in the above language; the English version was revised by a native speaker. A group of three experts in the dental area and two experts in the pedagogical/didactic and communication areas drew up the questionnaire together, paying the utmost attention to the simple and easy interpretation of the questions by the participants. Several selected project design examples were taken into consideration on the validity of the questionnaire [12–14]. The questions, reported in full in second table in Section 3, focus on the issues of awareness, communication, understanding in relation to the binomial dentist–parents and the liking in relation to the child. Using descriptive statistics, dichotomous responses (no/yes) were reported as absolute frequencies and percentages; the responses based on the scale of ten values (from 0 to 10) indicating the intensity of the phenomenon investigated were reported as mean values and relative standard deviations.

The internal consistency of the questionnaire was assessed through Cronbach’s alpha, which reflects the extent to which questionnaire items are related or whether they are consistent in measuring the same construct. Alpha values < 0.5 are indicative of unreliability;

values $0.5 \leq \alpha < 0.6$ indicate poor internal consistency, while values $0.6 \leq \alpha < 0.7$ indicate uncertain reliability. To have good internal consistency, a Cronbach's alpha between 0.7 and 0.8 is required, while alpha values between 0.8 and 0.9 and >0.9 indicate good or very good reliability, respectively.

Validated questionnaire on intraoral scanner effectiveness

Name (patient): _____ Surname: _____ Age: _____ Date: / /
 Name (parent)----- Surname _____

Instructions

Dear Parent,

For some time we are performing with the use of the intraoral scanner as a tool in the aid of diagnosis and setting for proper individual therapy. In the following questionnaire we asked several questions that will be useful to understand and improve the effectiveness of the use of the scanner. Please, read carefully and answer all the questions proposed.

**We recommend you to answer with a tick (x) and in case of error fix it visibly,
 Thanks.**

How much this aspects have improved?

0 = For nothing 1-3 = a little 4-5 = moderately 6-8 = a lot 9-10 = greatly

FOR THE PARENTS

1. Have you ever seen the use of the intraoral scanner?

Yes No

2. Do you think the scanner is a valid tool for the communication between the Medic and the patient?

0 1 2 3 4 5 6 7 8 9 10

3. Do you think it's better than classic dental impressions?

Yes No

4. How much better is your child's dental health awareness thanks to the scanner?

0 1 2 3 4 5 6 7 8 9 10

5. Do you think the scanner is a valid tool for the first visit to the dentist?

0 1 2 3 4 5 6 7 8 9 10

6. Do you think this new tool can improve the relationship between the kid and the dentist.

Yes No.

Figure 1. *Cont.*

7. During the use of the scanner did you notice fatigue in your child?
Yes No.
8. During the use of the scanner did you notice discomfort in your child? Has the child ever expressed the desire to interrupt the visit? If the the answer is "Yes" do you think it is due to the use of the scanner?
Yes No.
9. Did the visualization of the digital reconstruction of your son's mouth help to improve the understanding of therapeutic indications?
0 1 2 3 4 5 6 7 8 9 10
10. At the end of the visit do you notice that your child is more attentive to the doctor's instructions in comparison with the use of classic dental impressions?
0 1 2 3 4 5 6 7 8 9 10
11. In the future, knowing that we will use this method, will you feel more comfortable taking your child to the dentist?
0 1 2 3 4 5 6 7 8 9 10
- FOR THE YOUNG PATIENT**
1. How did you enjoy making the video of teeth from 1 to 10
0 1 2 3 4 5 6 7 8 9 10
2. Did it bother you the tool we used for the video of your teeth?
Yes No
3. Did you get tired during the video?
Yes No
4. How did you enjoy watching your mouth on the screen?
0 1 2 3 4 5 6 7 8 9 10
5. After the video of the teeth, did you understand the advice of the dentist?
Yes No.
6. In the future would you like to reuse the same tool?
Yes No.

Figure 1. Validated questionnaire on intraoral scanner effectiveness.

3. Results

A sample of at least 42 respondents was required for doubling the frequency of knowledge of intraoral scanner use, specifying an alpha level (α) = 0.05 and a beta (β) = 0.10 (study power = 90%).

Test–retest reliability, which was assessed in 49 of the 98 subjects enrolled, refers to the extent to which individuals' responses to questionnaire items remain relatively consistent after repeated administration of the same questionnaire (Table 2). The test–retest reliability was assessed through the percentage of agreement of the Cohen's kappa index for the nominal variables and the Intraclass Correlation Coefficient (ICC) (two-way mixed-effect; absolute agreement) for the scores indicated in the first and at the second visit (4 weeks after the first visit); values below 0.5, between 0.5 and 0.75, between 0.75 and 0.9 and above 0.90 are indicative of poor, moderate, good and excellent reliability, respectively. Intraclass Correlation Coefficients (ICCs) with a two-way mixed-effects model were used

to analyze the reliability for the scores indicated in the first and at second visit, according to Terry [15]. Based on the 95% confident interval of the ICC estimate, values less than 0.5, between 0.5 and 0.75, between 0.75 and 0.9 and greater than 0.90 are indicative of poor, moderate, good and excellent reliability, respectively. The processing was carried out using the STATA/BE 17.0 statistical package and the level of statistical significance was set at $p < 0.05$; a p -value < 0.05 was chosen because conventionally this level of significance is chosen (Table 3).

Table 2. Demographic characteristics of respondents (N = 98).

| | |
|---|--------------------------------|
| Children's Age, Mean \pm SD | 9 \pm 2.01 |
| Child sex, n (%) | |
| Male | 54 (55.10) |
| Female | 44 (44.90) |
| Parent, n (%) | |
| Father | 38 (38.78) |
| Mother | 60 (61.22) |

Table 3. Frequency distribution and mean scores of responses to the questionnaire.

| | N = 98 |
|---|-----------------|
| PARENT | |
| Q1. Have you ever seen the dentist use the intraoral scanner?, n (%) | |
| No | 51 (52.04) |
| Yes | 47 (47.96) |
| Q2. Do you think the scanner is a valid tool for patient–doctor communication?, mean \pm SD | 8.70 \pm 0.83 |
| Q3. Do you think this method is preferable to classic impressions?, n (%) | |
| No | 2 (2.04) |
| Yes | 96 (97.96) |
| Q4. How much has your child's dental health awareness improved after using this tool? mean \pm SD | 8.49 \pm 1.15 |
| Q5. Do you think the scanner is a valid tool for approaching the child on the first visit? mean \pm SD | 8.53 \pm 1.05 |
| Q6. Do you believe that this tool can change the relationship between the child and the dentist? n (%) | |
| No | 4 (4.08) |
| Yes | 94 (95.92) |
| Q7. Do you notice tiredness or discomfort in your child while using the scanner? n (%) | |
| No | 98 (100.00) |
| Yes | 0 (0.00) |
| Q8. Has the child ever expressed the desire to interrupt the visit? If the answer is yes, do you think it is due to the use of the scanner? n (%) | |
| No | 97 (98.98) |
| Yes | 1 (1.02) |
| Q9. How did viewing a digital reconstruction of your child's oral cavity help you understand the indications provided by the dentist? mean \pm SD | 8.45 \pm 1.15 |
| Q10. Once the visit is over, do you notice that your child is more inclined to listen to any indications compared to when the classic methodology was used? mean \pm SD | 8.35 \pm 0.95 |

Table 3. Cont.

| | N = 98 |
|--|-----------------|
| Q11. In the future, knowing that your child will be examined with this method, do you think they will feel more comfortable being taken to the dentist?, mean \pm SD | 8.35 \pm 1.07 |
| CHILD | |
| Q1. How much did you enjoy making the teeth video? mean \pm SD | 8.28 \pm 1.00 |
| Q2. Does the tool used to take a video of your teeth bother you? n (%) | |
| No | 96 (97.96) |
| Yes | 2 (2.04) |
| Q3. Are you tired of making a video of your teeth? n (%) | |
| No | 92 (93.88) |
| Yes | 6 (6.12) |
| Q4. How much did you like seeing your mouth on the screen? mean \pm SD | 8.22 \pm 0.98 |
| Q5. After the teeth video, did you understand what the dentist told you? n (%) | |
| No | 1 (1.02) |
| Yes | 97 (98.98) |
| Q6. Would you like it if we used the same method in the future? n (%) | |
| No | 0 (0.00) |
| Yes | 98 (100.00) |

VALIDATION-Internal Consistency

Internal consistency, assessed through Cronbach's alpha, reflects the extent to which questionnaire items are related or whether they are consistent in measuring the same construct. A Cronbach's alpha of at least 0.70 is required to indicate adequate internal consistency. In our case, the internal consistency was adequate, being alpha equal to 0.728. Test-retest reliability refers to the extent to which individuals' responses to questionnaire items remain relatively consistent after the repeated administration of the same questionnaire. The degree of agreement was assessed for the dichotomous variables through the Cohen's kappa index and for the discrete variables with the Intraclass Correlation Coefficient (ICC).

For the questions with a dichotomous answer, the reliability of the test was high: the percentage of agreement was >85.71% for all answers, except for the parent's Q1, for which the percentage of agreement was equal to 51.02% (Table 4).

Table 4. Test-retest reliability assessed with Cohen's kappa for dichotomous variables (N = 49).

| | Test | Retest | Agreement (%) | 95% CI | p-Value |
|---|------------|-------------|---------------|-----------|---------|
| PARENT | | | | | |
| Q1. Have you ever seen the dentist use the intraoral scanner? n (%) | | | | 0.33–0.69 | <0.001 |
| No | 27 (55.10) | 5 (10.20) | 51.02% | | |
| Yes | 22 (44.90) | 44 (89.80) | | | |
| Q3. Do you think this method is preferable to classic impressions? n (%) | | | | 0.76–1.00 | <0.001 |
| No | 2 (4.08) | 0 (0.00) | 95.92% | | |
| Yes | 47 (95.92) | 49 (100.00) | | | |
| Q6. Do you think this tool can change the relationship between the child and the dentist? n (%) | | | | 0.76–1.00 | <0.001 |
| No | 2 (4.08) | 0 (0.00) | 95.92% | | |
| Yes | 47 (95.92) | 49 (100.00) | | | |

Table 4. Cont.

| | Test | Retest | Agreement (%) | 95% CI | p-Value |
|--|-------------|------------|---------------|-----------|---------|
| Q7. Do you notice tiredness or discomfort in your child while using the scanner? n (%) | | | | 0.74–1.00 | <0.001 |
| No | 49 (100.00) | 46 (93.88) | 93.88% | | |
| Yes | 0 (0.00) | 3 (6.12) | | | |
| Q8. Has the child ever expressed the desire to interrupt the visit? n (%) | | | | 0.74–1.00 | <0.001 |
| No | 49 (100.00) | 46 (93.88) | 93.88% | | |
| Yes | 0 (0.00) | 3 (6.12) | | | |
| If the answer is yes, do you think it is due to the use of the scanner? n (%) | | | | | |
| No | - | 1 (33.33) | | | |
| Yes | - | 2 (66.66) | | | |
| CHILD | | | | | |
| Q2. Does the tool used to take a video of your teeth bother you? n (%) | | | | 0.74–1.00 | <0.001 |
| No | 47 (95.92) | 48 (97.96) | 93.88% | | |
| Yes | 2 (4.08) | 1 (2.04) | | | |
| Q3. Are you tired of making a video of your teeth? n (%) | | | | 0.66–1.00 | <0.001 |
| No | 49 (100.00) | 42 (85.71) | 85.71% | | |
| Yes | 0 (0.00) | 7 (14.29) | | | |
| Q5. After the teeth video, did you understand what the dentist told you? n (%) | | | | 0.70–1.00 | <0.001 |
| No | 1 (2.04) | 4 (8.16) | 89.80% | | |
| Yes | 48 (97.96) | 45 (91.84) | | | |
| Q6. Would you like it if we used the same method in the future? n (%) | | | | 0.76–1.00 | <0.001 |
| No | 0 (0.00) | 2 (4.08) | 95.92% | | |
| Yes | 49 (100.00) | 47 (95.92) | | | |

For the questions that expected to provide scores, the reliability was moderate ($0.5 < ICC < 0.75$) for Q4, Q9, Q11 of the parent and Q1 of the child; for the other answers the reliability was poor ($ICC < 0.5$) and not statistically significant (Table 5).

Table 5. Test–retest reliability assessed with the Intraclass Correlation Coefficient (ICC) for discrete variables (N = 49).

| | Test | Retest | ICC * (Average) | 95% CI | p-Value |
|--|-------------|-------------|--------------------|------------|---------|
| PARENT | | | | | |
| Q2. Do you think the scanner is a valid tool for patient–doctor communication? mean ± SD | 8.82 ± 0.86 | 8.73 ± 0.60 | −0.113 | −1.00–0.38 | 0.641 |
| Q4. How much has your child’s dental health awareness improved after using this tool? mean ± SD | 8.45 ± 1.32 | 8.55 ± 0.91 | 0.638 | 0.36–0.80 | <0.001 |
| Q5. Do you think the scanner is a valid tool for approaching the child on the first visit? mean ± SD | 8.67 ± 1.01 | 8.61 ± 0.89 | 0.240 | −0.36–0.57 | 0.176 |

Table 5. Cont.

| | Test | Retest | ICC * (Average) | 95% CI | p-Value |
|---|-----------------|-----------------|--------------------|------------|---------|
| Q9. How did viewing a digital reconstruction of your child's oral cavity help you understand the indications provided by the dentist? mean \pm SD | 8.47 \pm 1.39 | 8.59 \pm 0.93 | 0.452 | 0.02–0.69 | 0.021 |
| Q10. Once the visit is over, do you notice that your child is more inclined to listen to any indications compared to when the classic methodology was used? mean \pm SD | 8.47 \pm 1.08 | 8.59 \pm 1.08 | 0.207 | −0.42–0.55 | 0.215 |
| Q11. In the future, knowing that your child will be examined with this method, do you think they will feel more comfortable being taken to the dentist? mean \pm SD | 8.39 \pm 1.17 | 8.55 \pm 1.06 | 0.454 | 0.03–0.69 | 0.020 |
| CHILD | | | | | |
| Q1. How much did you enjoy making the teeth video? mean \pm SD | 8.47 \pm 1.02 | 8.43 \pm 0.84 | 0.583 | 0.26–0.77 | 0.002 |
| Q4. How much did you like seeing your mouth on the screen? mean \pm SD | 8.33 \pm 1.09 | 8.27 \pm 0.91 | 0.312 | −0.23–0.61 | 0.103 |

* Two-way mixed-effects model; absolute agreement.

4. Discussion

In the population taken into consideration in this study, children between 6 and 12 years old who underwent the intraoral scan and who participated in the completing the questionnaire at the Department of Pediatric Dentistry of the University of L'Aquila, we found that the Italian version of the “questionnaire on the effectiveness and satisfaction of the intraoral scanner in the growing patient”, developed by a group of Italian native speakers of different disciplines, has demonstrated good internal consistency and moderate retest reliability, satisfying its validity. The relatively limited size of the study did not allow us to find statistically significant differences based on gender. In agreement with the results of the questionnaire, we can state that the scanning of the arches, through the use of intraoral scanner, has the ability to positively interfere in generating awareness in the parent about the child's health, can interact in the trinomial dentist-child-parent communication and can be considered useful for detection of the footprint. For this last point, the results of the questionnaire confirm what already exists is present in the literature. The Italian version of the questionnaire proposed to children patients and their parents enjoys a satisfactory internal coherence index. Indeed, Cronbach's alpha had a value of 0.728. Test–retest reliability was moderate for four questions (for Q4, Q9, Parent's Q11 and Child's Q1) with a score ICC between 0.5 and 0.75. The remaining questions were considered statistically insignificant, having a score less than 0.5. Regarding the reliability of the dichotomous variables, the Cohen's kappa index stands at 81.75%; for this reason, it is considered highly reliable. Previous studies have shown how visualization and understanding the treatment helps the patient follow through the indications provided by the clinician. This mechanism is very similar to the behavioral technique Tell–Show–Do already present in the literature. From the results, in fact, we note that the visualization of the reconstruction of the model in 3D generates in the patient, rather than in the parent, a higher level of understanding (Figures 2 and 3).



Figure 2. Intraoral scan shows sealants on 3.6.



Figure 3. Example of intraoral scan with evidence of MIH.

The questionnaire included two types of responses: one dichotomous and the other based on a scale from 1 to 10. Observing the consistency of the retests, we notice that to obtain more predictable results, it is preferable to use dichotomous variants. They are characterized by great reliability and ease of administration, since they only allow two answers that oppose each other, leaving no doubt about the overall evaluation. The main limitations observed in this study are those inherent to the reliability of the responses in the retests. As mentioned previously, half of the participants were administered the questionnaire for the second time one month later. Despite the internal consistency, assessed through Cronbach's alpha, being adequate, in the retest, it was apparent we did not have the same result. In particular, in discrete variables, we note that questions Q2, Q5 and Q10 of the parent and Q4 of the child present a low degree of reliability. The limitation is due to the fact that the score is attributed using a scale numeric, which may be subject to significant variations between the first and the second survey.

To obtain better results, it will be better in the future to develop questionnaires aimed at children that include questions with dichotomous answers, so as not to confuse them with a vast numerical choice. Even if the experience was judged as positive overall, the final result is inconsistent in statistical terms.

Several studies have shown that the use of visual aids such as pictures or models can improve comprehension [10]. Although talking about teeth is a daily routine for dentists, it is often difficult for patients to understand their oral situation [16–18]. The results of the present study illustrate that IOSs are useful tools to visualize the oral situation in pediatric dentistry and improve the understanding of diagnosis and treatment planning. This appears to be particularly important regarding the significance of parental understanding, especially in vulnerable patient groups and patients with language barriers. The use of an

intraoral scanner and visual aids could improve the communication of treatment risks to people with limited language skills and medical knowledge [19].

The benefits of visual communication are already used in many ways in dentistry, and recorded images and models are effective tools for diagnosis, treatment planning and communication.

In Schulz-Weidner et al.'s 2024 study, a significantly higher understanding of children's oral situation was shown by the group of parents who were informed about their child's diagnosis and treatment planning with visual aids using IOS. This group showed better results in all questions than the group who received only verbal information without visual aids. The visualization tools seemed to be particularly useful, when information was provided in detail, such as which tooth was affected or which areas needed improvement regarding oral hygiene. Visualization support also significantly improved understanding regarding pending treatment. Additionally, the conditions that caused the planned treatment were better understood, which may result in better acceptance of the treatment. Individual patient IOSs are suited to present dental conditions with greater specificity and in a fully personalized manner. Numerous studies have shown that IOS have been found comparable to the clinical visual examination of the oral situation of school-age children [20]. However, intraoral scanners for documentation purposes only are not yet routinely performed in clinical, public health or research settings.

It has also been shown in the past that children show a greater acceptance of medical care when using digital technologies [21]. Furthermore, patients whose dental treatment included intraoral scanning reported greater comfort and less chair time compared to conventional impression techniques [22]. Especially when dealing with younger or more anxious patients, a skeptical attitude towards treatment can lead to lower treatment acceptance due to a lack of understanding of the need for treatment [23]. Special conditions such as MIH require intensive, long-term treatment. If the affected teeth are visualized to the patient and their carers during previous examinations, this can lead to a better acceptance of the planned treatment and therefore better preservation of the teeth.

5. Conclusions

Our study revealed that following the development and evolution of digital dentistry and thanks to the inclusion of new and continuously updated devices, pediatric dentistry has undergone notable changes. Regarding the trinomial communication approach of pediatric dentistry (parent–child–dentist), we observe that the visualization of the 3D scan and the simulation of the treatment contribute decisively to understanding the health status of the pediatric patient and the therapeutic indications of dentistry, leading the patient/parent to greater compliance and active participation during all phases of the treatment. In detail, we note a notable improvement in the first objective of the research, confirming that, after using the scanner, the parent acquires greater awareness of their child's oral health. Also, for the second objective, the scanner confirms that it is a tool capable of improving the efficiency of communication between the parent–dentist and child, positively influencing the communication trinomial of pediatric dentistry. In the third point, both parents and children prefer the optical impression scanning method rather than the traditional impression; all this is demonstrated by the results, which indicate a high degree of attention on the part of the child and a lack of discomfort during the visit, but also on the part of the parent, who express more peace of mind knowing that in the future their child will be treated in the same way.

In conclusion, the digital approach is confirmed not only as a powerful innovation from an engineering or clinical point of view, but also as a useful tool for more effective communication in the approach to the pediatric patient.

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