

Comparison of Digital vs. Conventional Impression Techniques in Pediatric Dentistry

Çocuk Diş Hekimliğinde Dijital ve Konvansiyonel Ölçü Tekniklerinin Karşılaştırmalı Olarak İncelenmesi

Sevgi ARABULAN¹

<https://orcid.org/0000-0002-3644-6712>

Ceren SAGLAM²

<https://orcid.org/0000-0002-8599-2701>

Selin YILMAZ³

<https://orcid.org/0000-0002-9968-8858>

Dilsah COGULU²

<https://orcid.org/0000-0002-3156-9801>

¹Department of Conservative Dentistry and Periodontology, University Hospital of Regensburg, Regensburg, Germany

²Ege University Faculty of Dentistry, Department of Pediatric Dentistry, İzmir, Turkey

³Private Dentist, Muğla, Turkey

Citation: Arabulan S, Sağlam C, Yılmaz S, Çoçulu D. Comparison of Digital vs. Conventional Impression Techniques in Pediatric Dentistry. *Int Arc Dent Sci.* 2026; 47(1): 1-8.

ABSTRACT

INTRODUCTION: This study aimed to compare the digital and conventional impression techniques in pediatric dentistry in terms of comfort, time perception, and overall preference.

MATERIAL and METHODS: The study included 60 children aged 7-12 years who applied to the Department of Pediatric Dentistry of Ege University Faculty of Dentistry for routine dental examinations. Ethical approval was obtained before the study. Digital impressions were obtained using an intraoral scanner, whereas conventional impressions were taken using dental trays and a silicone-based impression material. All procedures were performed by the same operator. Patient comfort was assessed by both the children and the clinicians during each impression-taking process, and chairside procedure times were recorded. Parental satisfaction was evaluated using a structured questionnaire. Statistical analyses were performed using SPSS 25.0 (Chicago, IL, USA), applying the t-test and Mann-Whitney U test, with the level of significance set at $p < 0.05$.

RESULTS: The mean duration of the digital impression was 3.28 ± 1.23 minutes, while that of the conventional impression was 4.61 ± 1.13 minutes, with no statistically significant difference between the two techniques ($p > 0.05$). However, digital impressions were perceived as more favorable by children, clinicians, and parents in terms of overall comfort and preference.

CONCLUSION: Digital impression techniques were found to be more comfortable for pediatric patients and were preferred by children, clinicians, and parents compared to conventional impression techniques.

Keywords: Conventional impression, digital impression, patient comfort, pediatric dentistry

ÖZ

GİRİŞ: Bu çalışmanın amacı, çocuk diş hekimliğinde dijital ve konvansiyonel ölçü tekniklerini konfor, işlem süresi algısı ve genel tercih açısından karşılaştırmaktır.

GEREÇ VE YÖNTEMLER: Bu çalışmaya, Ege Üniversitesi Diş Hekimliği Fakültesi Çocuk Diş Hekimliği Anabilim Dalı'na rutin diş muayenesi için başvuran 7-12 yaş arası 60 çocuk dahil edilmiştir. Çalışma öncesinde etik onay alınmıştır. Dijital ölçüler ağız içi tarayıcı kullanılarak elde edilirken, konvansiyonel ölçüler ölçü kaşıkları ve silikon bazlı ölçü materyali kullanılarak alınmıştır. Tüm işlemler standardizasyonu sağlamak amacıyla aynı operatör tarafından gerçekleştirilmiştir. Hasta konforu, her bir ölçü alma işlemi sırasında hem çocuklar hem de klinisyenler tarafından değerlendirilmiş, işlem süreleri kaydedilmiştir. Ebeveyn memnuniyeti yapılandırılmış bir anket ile değerlendirilmiştir. İstatistiksel analizler SPSS 25.0 (Chicago, IL, ABD) programı kullanılarak t-testi ve Mann-Whitney U testi ile gerçekleştirilmiş, anlamlılık düzeyi $p < 0,05$ olarak kabul edilmiştir.

BULGULAR: Dijital ölçü alma süresinin ortalaması $3,28 \pm 1,23$ dakika iken, konvansiyonel ölçü alma süresi $4,61 \pm 1,13$ dakika olarak bulunmuş ve iki teknik arasında istatistiksel olarak anlamlı bir fark saptanmamıştır ($p > 0,05$). Bununla birlikte, dijital ölçü tekniği çocuklar, klinisyenler ve ebeveynler tarafından genel konfor ve tercih açısından daha avantajlı olarak değerlendirilmiştir. **SONUÇ:** Dijital ölçü tekniğinin konvansiyonel ölçü tekniği ile karşılaştırıldığında çocuklar tarafından daha konforlu algılandığı ve klinisyenler ile ebeveynler tarafından konvansiyonel ölçü tekniklerine kıyasla daha fazla tercih edildiği belirlenmiştir.

Anahtar Kelimeler: Konvansiyonel ölçü, dijital ölçü, hasta konforu, çocuk diş hekimliği

Corresponding author: sglmceren@gmail.com

Received Date: 27.11.2024

Accepted Date: 13.03.2025

INTRODUCTION

Dental impressions are essential in pediatric dentistry, providing the foundation for accurate dental treatments. These impressions capture the intraoral environment with remarkable detail, serving as a critical determinant of procedural success and enhancing passive patient compliance during subsequent treatments.^{1,2} Conventional impression techniques have been the gold standard in pediatric dental care for decades, offering reliable and reproducible results.¹ These techniques involve using plastic or metal trays paired with impression materials like silicone or alginate. The accuracy of these impressions is influenced by factors such as the quality of the materials, the design of the trays, and the techniques of the operators.^{3,4}

Advancements in technology have revolutionized dental impression techniques, giving rise to digital impression systems.³ These systems offer numerous advantages, including faster procedures, three-dimensional (3D) visualization of intraoral structures, elimination of material degradation, efficient data storage, and seamless transfer of digital records between dental clinics and laboratories.^{4,5}

Since their introduction in the 1980s, digital impression systems, such as intraoral scanners, have gained widespread clinical application.^{4,6} Intraoral scanners are sophisticated 3D imaging devices that capture detailed intraoral structures by processing a series of high-resolution images through specialized software.³ Intraoral scanners are capable of accurately capturing even the most challenging-to-access dental areas, making them a versatile tool in clinical practice. Effective utilization of these devices requires clinicians to possess adequate knowledge and training in their operation.^{3,7,8} While initially developed for orthodontic and prosthetic applications, digital impression systems have also found significant utility in pediatric dentistry, aiding in diagnosis, treatment planning, fabrication of dental appliances, and space maintainers. The advantages of digital impressions, particularly in pediatric settings, include enhanced patient comfort, reduced chair time, and the elimination of conventional impression materials, all of which make them increasingly favorable compared to conventional techniques.^{6,9}

Digital impression has been a standard component of routine clinical practice for a significant period, but there remains a lack of sufficient studies evaluating its impact on patients' and clinicians' comfort. This study aimed to address this gap by comparing patients' comfort, acceptance, and preferences between digital and conventional impression techniques in pediatric dentistry.

MATERIALS AND METHODS

This study was conducted as a crossover randomized controlled trial involving 60 children aged 7-12 years who attended the Department of Pedodontics at Ege University Faculty of Dentistry for routine dentaexamination. The registration number of the study protocol is NCT06422611. The ethical approval was obtained by the Ethics Committee of the Faculty of Medicine at Ege University (Approval Number: 23-3.1T/12). Informed consent was obtained from all subjects, with detailed information provided regarding the purpose, duration, and protocols of the study.

Participants were included in the study based on the following criteria:

- Informed Consent: Both the patient and their parent provided consent to participate in the study.
- Lack of Prior Experience: The patient had no previous experience with dental impressions.
- Health Status: The patient did not present with any systemic and/or mental disorders.
- Behavior: Participants demonstrated cooperative behavior, as indicated by Frankl Behavior Rating Scale scores of 3 or 4.
- Medication Usage: The patient was not using any medications at the time of the study.
- Absence of Gag Reflex: It was confirmed that the patient did not exhibit a gag reflex.

Patients who failed to meet any of these criteria were excluded from the study.

In the present study, both digital and conventional impression techniques were conducted on all patients. To minimize potential bias, the sequence of impression techniques was randomized. For 50% of the patients, digital impression was initially performed, followed by the conventional technique. For the remaining 50% of cases, the sequence was reversed, with the conventional technique performed first, followed by the digital technique. The order of techniques for each patient was determined through a coin toss to ensure randomization. Figure 1 summarizes the study design.

The study encompassed three distinct areas of evaluation:

1. Patient Comfort: Wong-Baker Pain Rating Scale (10) was applied to measure the comfort levels of patients during the procedure.
2. Clinician Comfort and Time Monitoring: The clinician utilized a 5-point Likert scale to systematically evaluate the patient's experience with each impression technique. Additionally, the duration required for each impression procedure was meticulously recorded.
3. Parental Satisfaction: Parental satisfaction was evaluated using a structured questionnaire consisting of four targeted questions.

FLOWCHART

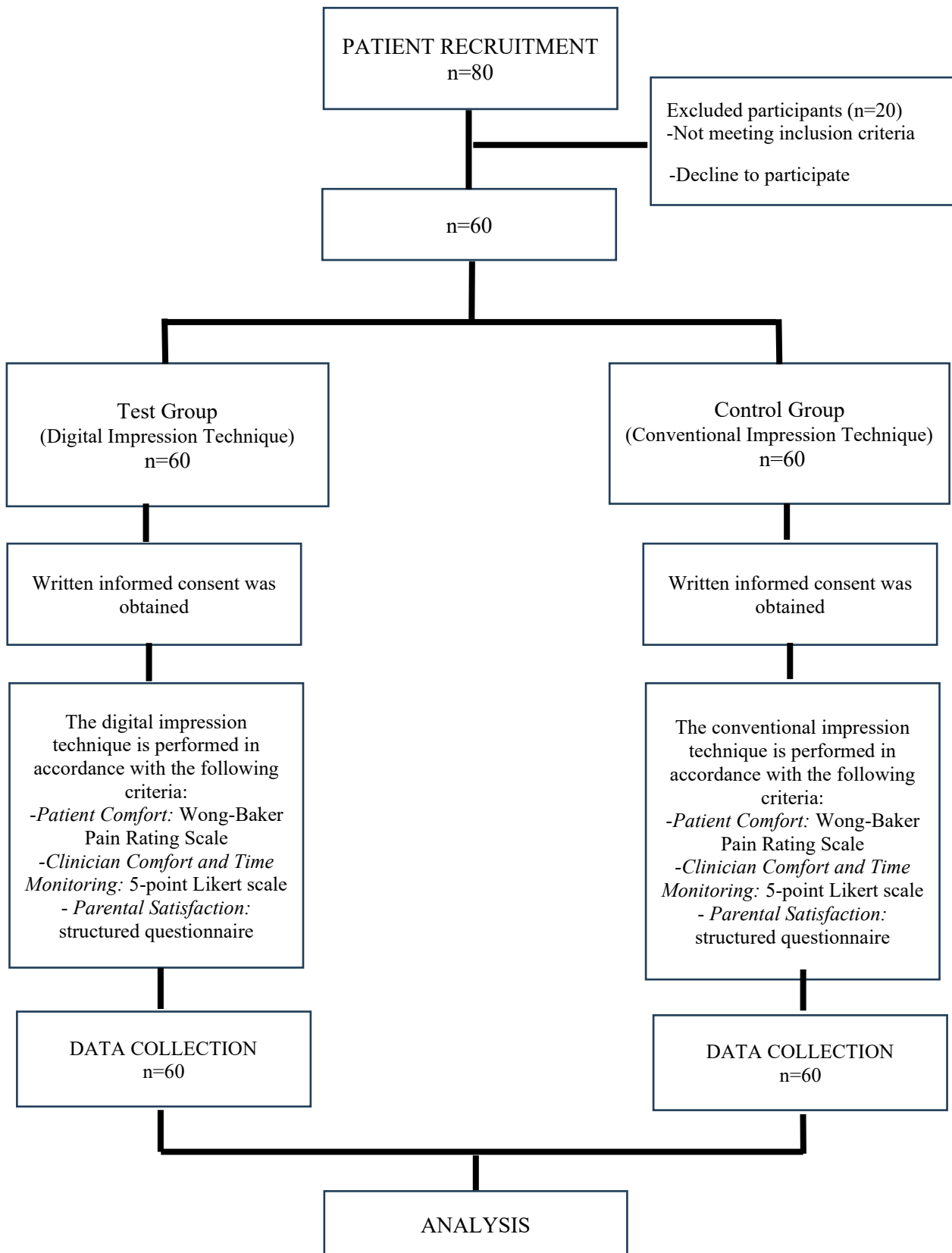


Figure 1. Flow chart summarizing the study process

The conventional impressions were conducted using the dental trays (DynaFlex disposable impression tray, Lake St. Louis, USA) and a type C silicone-based impression material (Stomaflex, SpofaDental, Czech Republic). The impression material was prepared following the manufacturer's instructions, and all procedures were performed by the same operator to ensure consistency.

The digital impressions were conducted using an intraoral scanner (Trios 3-Cart, Color-2017, 3Shape, Denmark), a device commonly employed in standard diagnostic and treatment workflows. To ensure consistency, all digital scans were performed by the same operator.

Statistical analyses were conducted by SPSS 25.0 (Chicago, Illinois, USA) using the t-test and Mann-Whitney U test, with significance set at $p < 0.05$.

RESULTS

The mean age of patients was 8.34 ± 2.06 years. Of the 60 patients, 56% were girls and 44% were boys. Among the patients, 23% were in the primary dentition, 56% in the mixed dentition, and 11% in the permanent dentition.







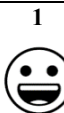


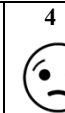


The mean duration for the digital impression was 3.28 ± 1.23 minutes, while the mean duration for the conventional impression was 4.61 ± 1.13 minutes. Statistical analysis revealed no significant difference between the duration of the two impression techniques ($p > 0.05$). No significant difference was found between age, gender, and the dentition of the patients and the duration of the impression techniques ($p > 0.05$).

The digital impression technique demonstrated significantly greater acceptability than the conventional impression technique in pediatric patients, specifically for general comfort ($p = 0.04$), breathing ease ($p = 0.02$), taste and smell comfort ($p = 0.02$), nausea ($p = 0.03$), gag reflex ($p = 0.01$), and pain ($p = 0.02$) based on Wong-Baker Pain Rating Scale (Table 1).

From the clinician's perspective, the digital technique was statistically significantly more favorable than the conventional technique concerning hand-arm movements ($p = 0.01$), gag reflex ($p = 0.01$), mouth opening ($p = 0.02$), and breathing comfort ($p = 0.02$). No significant differences were observed between the two impression techniques in terms of vomiting or crying ($p > 0.05$) (Table 2).

According to the parental satisfaction survey, 86% of parents expressed satisfaction with the digital impression technique (Table 3).

Table 1. Wong-Baker Facial Pain Scale for Assessing Patient Comfort in Two Impression Techniques

	Digital Impression						Conventional Impression					
	1 	2 	3 	4 	5 	6 	1 	2 	3 	4 	5 	6 
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
<i>General feelings</i>	50 (%84)	5 (%8)	3 (%5)	2 (%3)	0 (%0)	0 (%0)	35 (%60)	3 (%5)	10 (%16)	5 (%8)	2 (%3)	5 (%8)
<i>Breathing comfort</i>	55 (%92)	3 (%5)	2 (%3)	0 (%0)	0 (%0)	0 (%0)	20 (%34)	10 (%16)	5 (%8)	18 (%31)	2 (%3)	5 (%8)
<i>Taste/smell</i>	56 (%94)	2 (%3)	2 (%3)	0 (%0)	0 (%0)	0 (%0)	20 (%34)	0 (%0)	20 (%34)	5 (%8)	5 (%8)	10 (%16)
<i>Nausea</i>	54 (%90)	6 (%10)	0 (%0)	0 (%0)	0 (%0)	0 (%0)	18 (%30)	3 (%5)	2 (%3)	12 (%20)	5 (%8)	20 (%34)
<i>Gag reflex</i>	57 (%95)	3 (%5)	0 (%0)	0 (%0)	0 (%0)	0 (%0)	20 (%34)	20 (%34)	0 (%0)	5 (%8)	5 (%8)	10 (%16)
<i>Pain</i>	55 (%92)	5 (%8)	0 (%0)	0 (%0)	0 (%0)	0 (%0)	35 (%60)	3 (%5)	0 (%0)	10 (%16)	2 (%3)	10 (%16)

Yılmaz et al. conducted a comparison of digital and conventional impression techniques, utilizing the Visual Analog Scale (VAS) to assess patient comfort levels.¹⁷ This scale provides precise measurements and is commonly used in adult and elderly populations in the present study. In the present study, the Wong-Baker Faces Pain Rating Scale was used which uses facial expressions to denote pain levels, and is especially effective for children. Khatri et al. also reported that the Wong-Baker Faces Pain Rating Scale was more sensitive than the VAS when used with children aged 3-14 years.¹⁸

Few studies have specifically examined patient perceptions of impression techniques, with results varying across different age groups.¹⁹⁻²¹ Burhardt et al. found that young orthodontic patients aged 10-17 years preferred the digital impression technique over conventional alginate impressions.²² Bosoni et al. reported that children aged 6-11 favored digital impressions, citing advantages such as reduced procedure time, fewer breathing difficulties, and gag reflexes.²³ In the present study, the digital impression technique was found to be more comfortable than the conventional technique, as perceived by the patients (aged 7-12 years), clinicians, and parents.

Only patients with no prior experience with either impression technique were included in the study to minimize bias. A notable strength of the present study is using both impression techniques on the same patient, allowing for direct comparison. Furthermore, to eliminate potential inter-operator variability, all impressions were performed by a single operator.

The variation in results concerning taste across different studies may be attributed to the specific taste and odor characteristics of the impression materials used.^{24,25} Similarly, in digital impression techniques, unsatisfactory taste perceptions may arise due to the use of disinfectants or other cleaning agents employed during

the scanning process. These factors can influence the overall sensory experience of the patient, potentially impacting their evaluation of the procedure.^{26,27} The present study identified a statistically significant difference between the two impression techniques regarding taste and smell. Patients reported discomfort and dislike associated with the contact of the impression material in the mouth when using the conventional impression method.

The findings of the present study suggest that pediatric patients tend to find the digital impression technique more comfortable compared to conventional techniques. Few studies have specifically examined patient perceptions of both impression techniques, and results have varied. The literature reveals a notable gap, as no study to date has compared two distinct impression techniques while simultaneously evaluating patient comfort, clinician preferences, and parental satisfaction in the context of pediatric dentistry. In the present study, it was found that the digital impression technique was more favorable to patients, clinicians, and parents in terms of overall perception.

CONCLUSION

The findings of this study demonstrate that the digital impression technique offers superior comfort for both pediatric patients and clinicians compared to the conventional technique. This increased comfort may be attributed to the non-invasive nature and enhanced efficiency of the digital approach. Furthermore, the majority of parents expressed a clear preference for the digital impression technique for their children, highlighting its acceptability and potential to improve the overall dental experience. These results underscore the need for further research to explore the broader clinical applications of digital impressions in pediatric dentistry.

REFERENCES

1. Sjögren AP, Lindgren JE, Huggare JA. Orthodontic study cast analysis--reproducibility of recordings and agreement between conventional and 3D virtual measurements. *J Digit Imaging*. 2010;23(4):482-492. doi:10.1007/s10278-009-9211-y
2. Schieffer L, Latzko L, Ulmer H, et al. Comparison between stone and digital cast measurements in mixed dentition: Validity, reliability, reproducibility, and objectivity. Der Vergleich manueller versus digitaler Modellvermessung im Wechselgebiss: Validität, Reliabilität, Wiederholbarkeit und Objektivität. *J Orofac Orthop*. 2022;83(Suppl 1):75-84. doi:10.1007/s00056-022-00376-9
3. Caputi S, Varvara G. Dimensional accuracy of resultant casts made by a monophasic, one-step and two-step, and a novel two-step putty/light-body impression technique: an in vitro study. *J Prosthet Dent*. 2008;99(4):274-281. doi:10.1016/S0022-3913(08)60061-X
4. Ahmed S, Hawsah A, Rustom R, et al. Digital Impressions Versus Conventional Impressions in Prosthodontics: A Systematic Review. *Cureus*. 2024;16(1):e51537. Published 2024 Jan 2. doi:10.7759/cureus.51537
5. Davidovich E, Dagon S, Tamari I, Etinger M, Mijiritsky E. An Innovative Treatment Approach Using Digital Workflow and CAD-CAM Part 2: The

- Restoration of Molar Incisor Hypomineralization in Children. *Int J Environ Res Public Health*. 2020; 17(5): 1499. Published 2020 Feb 26. doi:10.3390/ijerph17051499
6. Yilmaz H, Aydin MN. Digital versus conventional impression method in children: Comfort, preference and time. *Int J Paediatr Dent*. 2019; 29(6): 728-735. doi:10.1111/ipd.12566
 7. Christopoulou I, Kaklamanos EG, Makrygiannakis MA, Bitsanis I, Tsolakis AI. Patient-reported experiences and preferences with intraoral scanners: a systematic review. *Eur J Orthod*. 2022; 44(1): 56-65. doi:10.1093/ejo/cjab027
 8. Mangano A, Beretta M, Luongo G, Mangano C, Mangano F. Conventional Vs Digital Impressions: Acceptability, Treatment Comfort and Stress Among Young Orthodontic Patients. *Open Dent J*. 2018;12:118-124. Published 2018 Jan 31. doi:10.2174/1874210601812010118
 9. Luniyal C, Shukla AK, Priyadarshi M, et al. Assessment of Patient Satisfaction and Treatment Outcomes in Digital Smile Design vs. Conventional Smile Design: A Randomized Controlled Trial. *J Pharm Bioallied Sci*. 2024;16(Suppl 1):S669-S671. doi:10.4103/jpbs.jpbs_928_23
 10. Wong DL, Baker CM. Pain in children: comparison of assessment scales. *Pediatr Nurs*. 1988;14(1):9-17
 11. Hyspler P, Urbanová P, Dostalova T. Comparison of the reverse scan technique with an intraoral scanner and the traditional impression technique. *J Prosthet Dent*. Published online September 30, 2024. doi:10.1016/j.prosdent.2024.08.012
 12. Vogler JAH, Billen L, Walther KA, Wöstmann B. Conventional cast vs. CAD/CAM post and core in a fully digital chairside workflow - An in vivo comparative study of accuracy of fit and feasibility of impression taking. *J Dent*. 2023;136:104638. doi:10.1016/j.jdent.2023.104638
 13. Alfallaj HA, Alsaloum MA, Altuwaijri SH, Aldibasi OS, Alkadi LT. Procedure Time and Students' Perception Comparing Full Arch Digital Scans with Conventional Impressions: A Cross-Over Randomized Experimental Trial. *Int J Dent*. 2022;2022:6320251. Published 2022 Oct 17. doi:10.1155/2022/6320251
 14. Carneiro Pereira AL, Medeiros VR, Campos MFTP, de Medeiros AKB, Yilmaz B, Carneiro ADFP. Conventional and digital impressions for complete-arch implant-supported fixed prostheses: time, implant quantity effect and patient satisfaction. *J Adv Prosthodont*. 2022;14(4):212-222. doi:10.4047/jap.2022.14.4.212
 15. Glisic O, Hoejbjerg L, Sonnesen L. A comparison of patient experience, chair-side time, accuracy of dental arch measurements and costs of acquisition of dental models. *Angle Orthod*. 2019;89(6):868-875. doi:10.2319/020619-84.1
 16. Jánosi KM, Cerghizan D, Mártha KI, et al. Evaluation of Intraoral Full-Arch Scan versus Conventional Preliminary Impression. *J Clin Med*. 2023;12(17):5508. Published 2023 Aug 24. doi:10.3390/jcm12175508
 17. Yilmaz H, Konca FA, Aydin MN. An Updated Comparison of Current Impression Techniques Regarding Time, Comfort, Anxiety, and Preference: A Randomized Crossover Trial. *Turk J Orthod*. 2021;34(4):227-233. doi:10.5152/TurkJOrthod.2021.21025
 18. Khatri A, Kalra N. A comparison of two pain scales in the assessment of dental pain in East delhi children. *ISRN Dent*. 2012;2012:247351. doi:10.5402/2012/247351
 19. Yuzbasioglu E, Kurt H, Turunc R, Bilir H. Comparison of digital and conventional impression techniques: evaluation of patients' perception, treatment comfort, effectiveness and clinical outcomes. *BMC Oral Health*. 2014;14:10. Published 2014 Jan 30. doi:10.1186/1472-6831-14-10
 20. Park HR, Park JM, Chun YS, Lee KN, Kim M. Changes in views on digital intraoral scanners among dental hygienists after training in digital impression taking. *BMC Oral Health*. 2015;15(1):151. Published 2015 Nov 27. doi:10.1186/s12903-015-0140-5
 21. Burzynski JA, Firestone AR, Beck FM, Fields HW Jr, Deguchi T. Comparison of digital intraoral scanners and alginate impressions: Time and patient satisfaction. *Am J Orthod Dentofacial Orthop*. 2018;153(4):534-541. doi:10.1016/j.ajodo.2017.08.017
 22. Burhardt L, Livas C, Kerdijk W, van der Meer WJ, Ren Y. Treatment comfort, time perception, and preference for conventional and digital impression techniques: A comparative study in young patients. *Am J Orthod Dentofacial Orthop*. 2016;150(2):261-267. doi:10.1016/j.ajodo.2015.12.027
 23. Bosoni C, Nieri M, Franceschi D, Souki BQ, Franchi L, Giuntini V. Comparison between digital and conventional impression techniques in children on preference, time and comfort: A crossover randomized controlled trial. *Orthod Craniofac Res*. 2023;26(4):585-590. doi:10.1111/ocr.12648
 24. Zarbakhsh A, Jalalian E, Samiei N, Mahgoli MH, Kaseb Ghane H. Accuracy of Digital Impression Taking Using Intraoral Scanner versus the Conventional Technique. *Front Dent*. 2021;18:6. Published 2021 Feb 10. doi:10.18502/fid.v18i6.5649
 25. Lim JH, Mangal U, Nam NE, Choi SH, Shim JS, Kim JE. A Comparison of Accuracy of Different Dental Restorative Materials between Intraoral Scanning and Conventional Impression-Taking: An

- In Vitro Study. *Materials (Basel)*. 2021;14(8):2060. Published 2021 Apr 19. doi:10.3390/ma14082060
26. de Paris Matos T, Wambier LM, Favoreto MW, et al. Patient-related outcomes of conventional impression making versus intraoral scanning for prosthetic rehabilitation: A systematic review and meta-analysis. *J Prosthet Dent*. 2023;130(1):19-27. doi:10.1016/j.prosdent.2021.08.022
27. Gallardo YR, Bohner L, Tortamano P, Pigozzo MN, Laganá DC, Sesma N. Patient outcomes and procedure working time for digital versus conventional impressions: A systematic review. *J Prosthet Dent*. 2018;119(2):214-219. doi:10.1016/j.prosdent.2017.07.007