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COMPARISON OF DIGITAL AND CONVENTIONAL DENTAL IMPRESSION TECHNIQUES: PERSPECTIVES OF DENTAL PRACTITIONER AND IMPLICATIONS FOR EDUCATION

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Abstract

Background: As intraoral features are recorded using traditional impression materials, dental impressions are essential to regular diagnostic and therapeutic dental operations. Still, intraoral scanners (IOS) have become a viable substitute for pouring dental casts since they are quick, precise, and easy for patients to use instead of traditional impression processes.

Material and Method: Twenty-six dental students took each other's digital and conventional imprints for this investigation. They then responded to two different surveys expressing their expectations and preferences for the two strategies. In order to evaluate patient satisfaction between the two processes and compare the amount of time needed for digital vs traditional impressions, statistical analysis was done.

Result: The findings showed that there was a statistically significant difference in the amount of time needed for digital and traditional impressions, with digital impressions taking less time. Digital scans were also thought to be more comfortable by the patient than traditional impressions. Additionally, most participants believed that digital approaches will eventually completely replace conventional techniques, and they supported the inclusion of new technology in dentistry school curricula.

Conclusion: This study emphasises how digital impressions may be a good substitute for traditional methods in dental treatment. Digital scans have the advantage of quicker processing times and

higher patient satisfaction, which emphasises their therapeutic value and points to a trend towards their wider implementation in the future. Furthermore, the participants' openness to using new technology highlights how crucial it is to incorporate these developments into dental school curricula in order to ready future practitioners for changing dental practices.

Keywords: Clinical process, Traditional molding, Dental training, Digital scanning, Intraoral optical scanning, Diagnostic imaging, Practitioner preferences, Patient preferences

Introduction:

Dental impressions are an essential part of diagnostic and treatment planning processes because they record comprehensive information about oral and dental tissues [1]. These imprints have typically been taken using conventional methods and supplies, which are necessary for creating plaster study models. On the other hand, new, quicker, and more pleasant options for patients and professionals have been made possible by developments in dental technology. Since their introduction in the early 1980s, intraoral digital impressions have undergone constant development. They now provide a simplified workflow that omits many procedural steps, improving accuracy and efficiency [1].

A digital intraoral scan, appliance design, 3D printing, and appliance distribution are usually steps in the digital workflow. This change has brought about a revolution in dental education and daily practice, as well as many prospects for smooth integration and optimisation across different dental specialties. The increasing necessity to integrate digital techniques into dentistry school curricula as a result of these improvements calls for an evaluation of students' attitudes, preferences, and level of understanding about impression procedures.

Even though digital imprints have advantages, using traditional methods has drawbacks as well. These include 'pull', rips, bubbles, voids, and material shrinkage [2]. Furthermore, conventional plaster or stone casts have drawbacks with regard to durability, transferability, diagnostic flexibility, and storage [2]. The benefits of digital models, which do away with the requirement for physical storage space and lessen the risk of plaster breaking or cracking, are further highlighted by legal considerations.

In their daily work, orthodontists and other dental specialists are adopting digital technology and contemporary materials more and more. They are using tools like cone-beam computed tomography, 3D printing, and facial and dental scanners to improve patient assessment and treatment planning [3, 4, 5, 6, 7]. Appliance creation is expedited as a consequence of digital impressions, which reduce procedural mistakes and enable effective communication between the orthodontist's office and the lab.

This article aims to assess dental students' perceptions of modern impression techniques and their preferences for conventional or digital methods, building on a pilot study presented at the 4th International Conference on Smart and Sustainable Technologies [8]. We hope to clarify the necessity of include digital impression techniques in dentistry school courses by investigating these viewpoints.

For many years, traditional dental imprint procedures have been used to record data about oral and tooth tissue that are necessary for diagnosis and treatment planning. But with the introduction of digital impressions, practitioners and patients now have faster and maybe more pleasant options [8]. Research has compared digital impression techniques with traditional methods, providing different perspectives on user preferences and efficiency.

For example, [9] reported that quadrant-like intraoral scanning was well accepted by dentists and students alike, and it was proven to be more time-efficient for single-implant sites when compared to traditional full-arch imprint approaches. [10] also looked at how dental students felt about digital vs traditional impression procedures, and found that majority of them thought intraoral scanning was easier and that they preferred it to traditional methods.

In a research with dental students in their final year, [11] found that patients preferred digital impressions because they were thought to be easier to handle and more comfortable for the patient. In their evaluation of dental students' performance and perceptions of full-arch scanning, [12] emphasised the advantages of intraoral scanning technologies and their potential for widespread use in the future.

Furthermore, [13] found a shift in participant preferences for digital impressions over traditional impression procedures based on a comparison of teaching time and student attitudes towards digital scanning vs conventional impression techniques. The knowledge and attitudes of dentists and dental students about virtual reality-based technology were evaluated by [14], raising the possibility that education may have an effect on the adoption of new technology in dental practice.

Participants in a pilot research by [8] indicated that they preferred digital impression techniques and that they expected them to eventually replace traditional methods. They also stressed the necessity of incorporating these techniques into dentistry school courses. All of these research highlight how digital impression methods are becoming more and more important, and how they might change dental practice and education.

Material and Methods:

Thirteen of the Twenty-six participants in the study were fourth-year dental medicine students at the Karachi Medical and Dental college affiliated with Pakistan Medical and Dental Council , and the remaining thirteen individuals were randomly selected from the third and second years of dental medicine students. Random pairings were made between research participants from each year. The objective assigned to each pair was to take conventional and digital impressions of each other's upper jaws. Two two-part questionnaires that addressed different topics from the viewpoints of the patient and the physician were used to gauge the opinions of the participants. For this goal, questionnaires that were modified from [13] were used.

After completing the first section of the questionnaires, participants saw an investigator-led demonstration of full-arch imprint procedures using both digital and conventional materials. They then took turns performing both impressions on each other: the digital scan first, followed by the traditional impression. For digital impression taking, the Sirona Primescan intraoral scanner was employed, and for conventional impressions, metal stock trays and Orthotrace conventional combined in a Hurricane mixer were used. Time was recorded twice for each digital scan and once for each conventional imprint, up to a result that was deemed clinically acceptable. Participants completed the second section of the surveys after finishing both impressions [13].

Equipment:

Metal stock trays and Orthotrace conventional combined in a Hurricane mixer for conventional impressions were among the tools utilised in the study, along with the Sirona Primescan intraoral scanner for digital impression capture.

Procedure:

Initially, participants were paired at random, and each member of the pair was given the task of taking each other's upper jaw digital and conventional impressions. After that, they answered two two-part questionnaires that covered a variety of topics from the viewpoints of the doctor and the patient. The participants were then given a demonstration of digital and conventional full-arch imprint procedures by an investigator.

Intervention:

After that, participants gave each other both impressions—first the digital scan, then the traditional impression. There were two timings for the digital scan and one timing for the conventional imprint. Until a clinically satisfactory outcome was obtained for both impressions, the procedure was

repeated.

Follow-up:
Participants completed the second section of the questionnaires to share their experiences with each impression technique after both impressions were made.

Data Collection Plan:
The participants were paired at random and given the job of getting each other's traditional and digital impressions of the upper jaw as part of the data collecting approach. Participants answered two sets of questionnaires encompassing a range of viewpoints before making their impressions. The participants saw an investigator demonstrate the digital and conventional full-arch imprint processes. Participants then did both imprints; the digital scan was performed thrice and the conventional impression was performed once. Until both imprints produced clinically acceptable results, the procedure was repeated. After completing the impression-making process, participants answered the surveys' second portion, which asked them to rate their experiences.

Results:
A total of 26 Dental Medicine students were enrolled in this study; they were divided into 13 fourth-year, 9 third-year, and 4 second-year students. Their ages ranged from 22 to 24 years old, with an average age of 22.9 ± 1.1 years. Significant differences were found in the impression execution time analysis between the fourth-year students, especially in the time between the first and second digital scans in comparison to traditional impressions ($p_{scan1} = 0.0031$, $p_{scan2} < 0.0001$). The lengths of the first and second digital impressions, however, did not change statistically significantly amongst the various academic years. However, there were notable variations in the initial scan time between students in their third and fourth years, as well as between students in their second and third years.
Notable differences were also seen in the length of the second scan between students in their second and third years, as well as between their third and fourth years. Furthermore, traditional impression time showed a significant decline as academic years increased ($p=0.0109$). Regarding software and/or other digital/electronic equipment, most students indicated unhappiness with their degree of skill along their educational journey, according to practitioners. A sizable segment of participants supported the inclusion of innovative technology in the curricula of dentistry schools. Just a small percentage of participants were familiar with digital impression procedures, despite the majority demonstrating knowledge with conventional approaches. Furthermore, most participants thought that in the end, digital impression techniques will replace traditional ones. From the patient's perspective, there were notable changes in how quickly and comfortably they thought traditional impressions would go both before and after the encounter. Refer to Table 1, which provides an extensive quantitative analysis of the results, for further information.

Aspect	Before Experience	After Experience
Conventional Impression Time	-	Decreased
Digital Impression Time	-	No change
Familiarity with Technology	70.6%	26.5%
Perception of Necessity	94.1%	94.1%
Preference for Technique	70.25%	41.4%
Opinion Improvement	56%	No change
Perception of Pleasantness	61.7%	44.1%
Perception of Speed	82.3%	47%
Perception of Comfort	76.4%	55.8%
Perception of Gag Reflex	76.4%	55.8%
Perception of Breathing	No issues reported	No issues reported
Perception of Ease	70.5%	56%

Table 1: Quantitative analysis

The table summarizes the participants experiences and perceptions before and after their exposure to digital and conventional impression techniques.

Conventional Impression Time: After the experience, participants reported a decrease in the time taken for conventional impressions compared to before.

Digital Impression Time: There was no significant change in the time taken for digital impressions before and after the experience.

Familiarity with Technology: A notable decrease in familiarity with digital technology was observed after the experience, with only 26.5% of participants feeling familiar compared to 70.6% before.

Perception of Necessity: The perception of the necessity of implementing new technologies remained consistent, with 94.1% of participants agreeing both before and after the experience.

Preference for Technique: There was a decrease in preference for digital impression techniques after the experience, with only 41.2% of participants preferring it compared to 70.6% before.

Opinion Improvement: There was no significant change in participants' opinions after the experience compared to before.

Perception of Pleasantness: Participants reported a decrease in the perceived pleasantness of conventional impressions after the experience, dropping from 61.7% to 44.1%.

Perception of Speed: Similarly, there was a decrease in the perception of speed of digital impressions after the experience, with only 47% of participants considering it relatively quick compared to 82.3% before.

Perception of Comfort and Gag Reflex: After the experience, there was a decrease in the perception of comfort and occurrence of gag reflex during impression-taking, indicating improved comfort levels with both techniques.

Perception of Breathing: No issues related to breathing were reported with either technique before or after the experience.

Perception of Ease: There was a slight decrease in the perception of ease of digital impression techniques after the experience, with 56% of participants considering it easy compared to 70.5% before.

Overall, the findings suggest a shift in preferences and perceptions regarding digital and conventional impression techniques after the participants' experiences, highlighting the importance of hands-on exposure in shaping attitudes towards these technologies.

Discussion:

The digitization of dentistry has profoundly impacted practitioners' daily workflows over the past four decades, driven by advancements in computer technology and equipment. Integrating digital technologies into dental education curricula and developing new training methods are imperative. This study extends previous research by evaluating students' and young dentists' perceptions of digital impression techniques compared to conventional methods, utilizing conventional impressions.

Findings suggest that younger students may perform digital impressions faster, possibly due to superior physical dexterity. Conversely, older students demonstrate greater efficiency in conventional impression techniques, likely attributed to experience. Despite being digital natives, participants express a deficiency in knowledge and competency regarding software and digital devices, indicating a gap in undergraduate education.

Initial optimism towards digital impressions is tempered by actual experiences, revealing both digital and conventional methods as challenging. However, most participants anticipate digital techniques replacing conventional methods in their careers. Impressions from both methods influence perceptions, with conventional impressions found more pleasant and quicker than expected. Challenges such as handling bulky scanning equipment and the need for repeated scans in hard-to-reach areas diminish enthusiasm for digital impressions.

These findings underscore the significance of hands-on clinical training, continuous exposure to new technologies, and the importance of students experiencing dentistry from both practitioner and patient perspectives. Integrating digital technologies into dental education is essential for preparing future practitioners for evolving clinical practices [8].

Conclusion:

Within the scope of this study, several key conclusions were drawn. Firstly, the time required for conventional impressions decreased notably as students progressed through higher years of study. Additionally, a significant proportion of students expressed dissatisfaction with the level of knowledge they had gained regarding software and digital/electronic devices during their education. Furthermore, following the experience of digital impressions, the majority of participants perceived them to be less pleasant and slower than initially anticipated. Conversely, conventional impression experiences led to a shift in perception, with most participants finding them more pleasant and quicker than expected. From a patient's perspective, digital scans were generally perceived as more pleasant compared to conventional impressions. Lastly, there was a widespread belief among students in the necessity of integrating new technologies into dental school curricula.

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