

Difficulties in Taking an Impression with an Intraoral Scanner and Making Constructions by Digital Method

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Abstract: Introduction: There are three necessary units of a working digital protocol - an intraoral scanner, a software where the data is processed and the design of the future structure is created and a manufacturing unit. All of the prosthetic structures on implants, require an exact fit of the fixed prosthetic structure to the abutment, whether cemented or screw - retained. When doing the scanning method, it is necessary to transfer the exact position of the implant and to process this information by the software. Aim: The purpose of this article is to examine the main difficulties of taking an impression using an intraoral scanner, as well as those that had arisen after the fabrication of constructions by digital method. Materials and methods: A survey among dentists was conducted, concerning their preferences for taking impressions of implants in the city of Varna. The survey was available on the website of BZS Varna. It was provided electronically via Google Forms. For the time period of April to May 2023, 61 dentists gave their professional opinion. The obtained results were processed with SPSS v.20.0 for Windows. Results: The majority of the respondents are general practitioners in dentistry (68.5%), 26.3% are specialized in prosthetic dentistry and the rest (5.2%) are with qualifications in oral surgery and operative dentistry and endodontics. The results of the study show that some doctors often have difficulties with the scanning method, but most of them do not know which particular area is problematic. The same issue refers to the accuracy and adjustment time of the restorations. This leads to the conclusion that the introduction of digitization in the working process is still complex for clinicians and requires long training time by dental doctors and dental laboratories. Conclusion: Without a doubt, digital impressions have many advantages for dentistry compared to conventional methods. However, difficulties related to the peculiarities of the prosthetic field, as well as clinical and laboratory ones, are noticed.

Keywords: intraoral scanner, digital impression, CAD/CAM, scan body

1. Introduction

Intraoral scanners are a huge innovation for the dental medicine overall. This technology has brought in a new way of taking impressions from the prosthetic field. In recent years they are proven to be an effective alternative for the conventional method of transferring data from clinics to dental laboratories. There are three necessary units of a working digital protocol - an intraoral scanner, a software where the data is processed and the design of the future structure is created and a manufacturing unit [1, 2].

There are many factors that affect the accuracy of intraoral scanning, such as: the type of scanning system along with the software, the scanning protocol, the time needed for scanning, the size of the scanner, the features of the prosthetic field and the use of reflecting agent. The exact impression taking from implants has its requirements as well. They are presented as: the design of the scan body, the position of the implants, the size of the scanned area, the experience of the operator. The use of intraoral scanners for taking impressions has a number of advantages over the conventional method, but requires a training time by the clinicians [3, 4, 5, 6].

Factors that represent potential risk of scanning errors are the presence of saliva and blood, adjacent structures, different scanning techniques, features of the prosthetic field. Another serious issue when taking digital impressions is the scanning of hard - to - reach areas. For example - deeper finish lines or such in the proximal areas where light

cannot fully reach. This step could be extremely complex in case of bleeding when the finish lines remain "invisible". For this reason, retraction is mandatory, even when using digital impressions. The presence of restorations adjacent to the scanned area can also lead to inaccuracies due to differences in the light reflection, depending on the material of the construction. [7, 8]

There are sources of information about digital impressions in literature, but scan bodies and their impact on impressions accuracy are not fully examined yet. After 2008 with the rapid penetration of digitalization, the "coping bodies" also appear. The Straumann Group gave them the name "scan bodies".

Various scan bodies have been developed by manufacturers for taking a digital impression of implants. A scan body is positioned on each implant to transfer the three - dimensional position of the implant to the CAD software via an STL file (Standard Tessellation Language). This is followed by transferring and processing the data in the CAD software and placing the implant analog in the digital 3D model. [11, 12, 13]

All of the prosthetic structures on implants, require an exact fit of the fixed prosthetic structure to the abutment, whether cemented or screw - retained. When doing the scanning method, it is necessary to transfer the exact position of the implant and to process this information by the software [11, 14, 15].

One of the main difficulties is when it comes to marginal and internal fit of prosthetic structures made by both conventional and digital impression. In order to ensure the permanence of the restorations, it is necessary to provide proper hygiene conditions, so that the periodontal tissues can be in good health. The relationship between the periodontal tissues and the prosthetic suprastructures is key to ensuring adequate form, function and aesthetics of the dentition. [15, 16]

Some studies about the marginal and internal fit of non - removable structures show that zirconia crowns made by digital impression have less discrepancies compared to those made by conventional technique. [17, 18]

According to some authors, marginal discrepancy within 100 µm is considered clinically acceptable, while others claim that the restorations are considered successful only below 20µm. Holst and his team examine this parameter by using a 3D technique to measure the accuracy of fitting non - removable structures. They scan the non - removable structure in several stages from the inside and outside, the working model and the restoration on it. After measuring from detached endings and summing up the results, they calculated that the internal discrepancy between the structure and the abutments was 117 µm using the conventional method and 93 µm using the digital one. Regarding the marginal discrepancy, they did not observe a large difference between the two techniques. [19, 20, 21]

There are also studies on the fabrication time and the need for adjustments of single crowns on implants that are fabricated using a fully digital and partially digital protocol.

According to the research, constructions are completed for the same number of visits. No corrections were required for the patients whose operations were followed with a fully digital work protocol, while for the patients with a combined protocol corrections of the interproximal and occlusal contacts were needed. [7, 22]

2. Results

The majority of the respondents are general practitioners in dentistry (68.5%), 26.3% are specialized in prosthetic dentistry and the rest (5.2%) are with qualifications in oral surgery and operative dentistry and endodontics. Regarding the question of what are the biggest difficulties when taking an impression with an intraoral scanner, the largest group answered that it was the presence of saliva in the oral cavity 18 (29, 5%), for others it was gag reflex 4 (6, 56%), and least troubles were experienced with patient movements 3 (4, 91%). Quite a large number of respondents answered that they had no opinion on this matter 24 (39, 34%), 12 from the respondents have answered that they have more than one difficulty while taking an impression with an intraoral scanner (19.69%). Fig.1

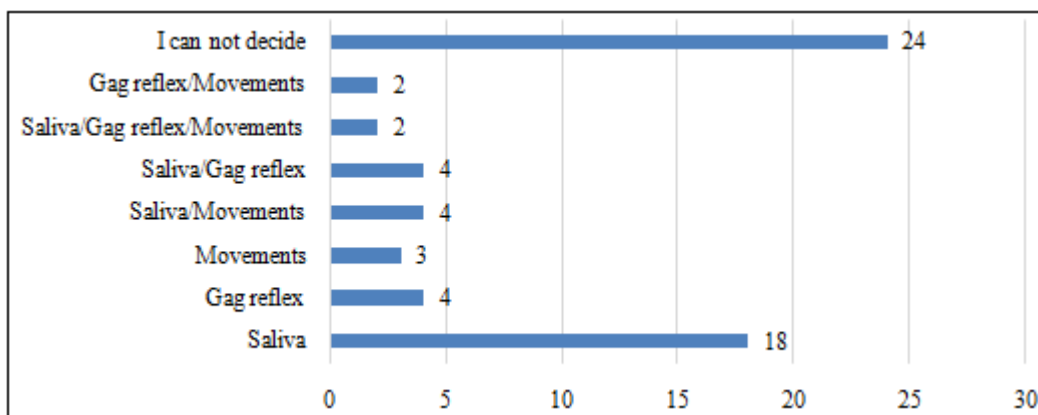


Figure 1: Distribution of answers to the question: “What are the biggest difficulties when taking an impression with an intraoral scanner?”

A large number of respondents indicated that they had difficulty scanning some areas of the prosthetic field, but could not figure out in which area particularly - 33 (54, 09 %), 4 (6, 56%) experienced difficulty with the proximal

area, 5 (8, 19%) in the area of the finish line and 11 (18.03%) of the surveyed had no difficulties, 8 of the respondents (13, 13%) pointed proximal zone and preparation border. Fig 2

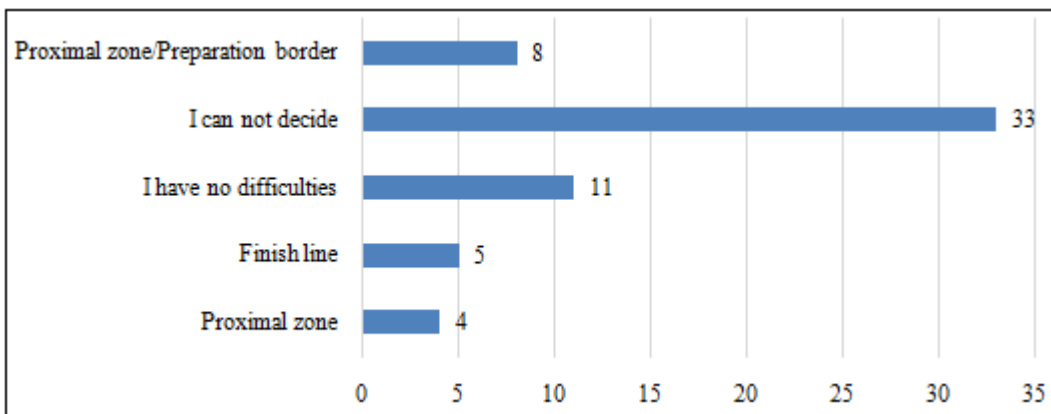


Figure 2: Distribution of answers to the question: “Do you have difficulty scanning some areas of the prosthetic field? “

When asked how they consider the time for taking a conventional transfer impression compared to a digital one with a scan body, 25 (40, 98%) had no opinion, 21 (34.43%) were in favor of the digital method, 7 (11, 47%) were in favor of the conventional method and for 8 (13, 12%) there was no difference between the two options. Fig.3

During of adjustment of a structure using both conventional and digital protocol, a large part of the respondents could not decide whether there is a difference between the two methods - 32 (52, 46%), 14 (22.95%) of the respondents couldn't find any differences, 13 (21, 31%) have picked digital and the rest 2 (3, 28%) have chosen conventional. Fig 4

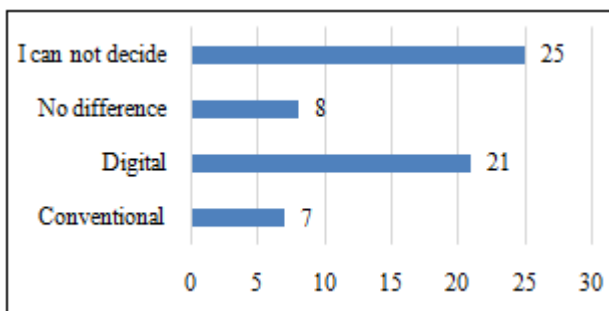


Figure 3: Distribution of answers to the question: How do you consider the time for taking a conventional transfer impression compared to a digital one with a scan body? “

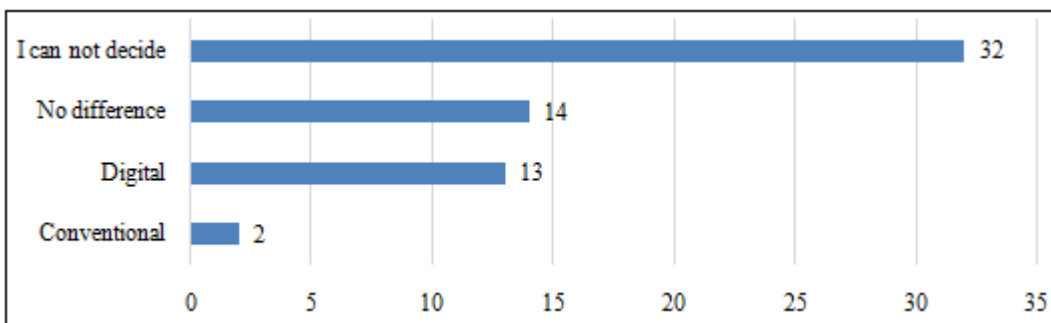


Figure 4: Distribution of answers to the question: Is there a difference during of adjustment of a structure using both conventional and digital protocol?

Regarding the matter of differentiation with the accuracy of the construction made with a digital or conventional protocol, and in which area particularly any discrepancies occur, a large number of doctors also showed they could not figure out a specific conclusion - 29 (47.54%). For 2 (3,

28%) of the doctors there is a difference in approximal contacts, for 3 (4, 92%) - in occlusal contacts, for 3 (4, 92%) - in marginal adaptation and 12 (19.67%) of the surveyed believe there is no difference in accuracy.11 (19, 67%) of the respondents have chosen more than one answer. Fig 5.

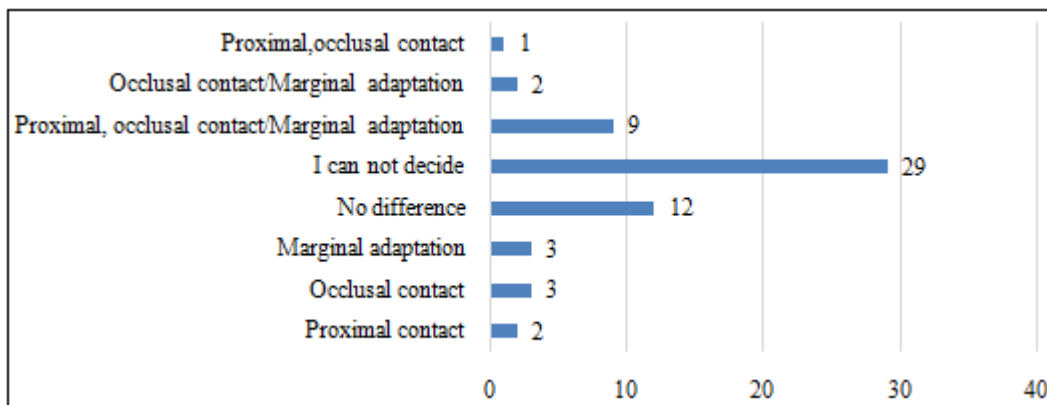


Figure 5: Distribution of answers to the question: "Is there a difference with the accuracy of the construction made with a digital or conventional protocol and in which area? "

3. Discussion

Digitalization in dentistry is accelerate with the introduction of a number of scanning devices, softwares for the design of structures and manufacturing through additive or subtractive technology. Despite the advantages of these devices and the reduction of the risk of clinical and laboratory errors, there are some difficulties related to both of the scanning and manufacturing process. Discrepancies may occur in the presence of oral moisture, saliva, blood or in existing restorations adjacent to the scanned area of the prosthetic field. Available restorations and the material from which they are made are also important, because of the different reflection of light. There is a risk of not reaching the area that should be scanned well enough and this affects the accuracy of the approximal contacts of the restoration. According to literature sources, there is no significant difference in the number of visits for the two methods. Regarding the need for corrections in the interproximal area, occlusal contacts and marginal adaptation, there are better results in the digital protocol to work for the fabrication of prosthetic restorations.

4. Conclusion

The information from the conducted study shows that some doctors have difficulty with the scan, but a large part of them cannot decide in which area. The same applies to the accuracy and adjustment time of the restorations. This leads to the conclusion that the introduction of digitization into the work process is still difficult for clinicians and requires long trainings to be taken by dentists and dental laboratories. Despite the rapid pace of development of digital technologies in dentistry, their application is not as quickly applicable in practice as technical development.

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