

Clinical Assessment of Two Modified Implant Impression Copings by means of Visual Analog Scale

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Abstract

Background: Dental implant impression taking may carry inaccuracies related to the impression coping.

Purpose: Evaluate the difficulty, efficiency and future use of conventional and modified dental implant impression copings.

Material and methods: 25 residents of two specialty fields in dentistry made two impressions of dental implants using: conventional impression copings after creating additional retention with auto polymerizing acrylic resin (CICAAR); and, modified implant impression coping with retention screws (MIICRS). A visual analog scale (VAS) questionnaire was used to assess difficulty, efficiency, and preference for the two methods used by the residents. In addition, the probability of replacing one method for the other in their future practices was registered. Wilcoxon Test was used for statistical analysis.

Results: The mean difficulty levels for the impressions made were: 43.74 (\pm 23.31) and 20.79 (\pm 23.66), for the CICAAR and the MIICRS, respectively. Of 25 residents, 88% preferred the MIICRS, 92% reported the MIICRS most effective, and 80% reported that the MIICRS will replace the conventional implant impression copings in their practices. All evaluations were statistically significant ($p < 0.05$).

Conclusions: According to the residents' perceptions, the MIICRS was more efficient, user friendly and more prone to be used in their future practice when compared with the CICAAR.

Keywords: Visual analog scale; Modified impression copings; Single-unit implants

Introduction

The high rate of dental implant supported prostheses survival (96.3%) in 5 years [1] indicates this to be a valid treatment option for rehabilitation of the missing dentition [2]. The success of this treatment modality depends on several factors, such as: precise fit of the abutment on the implant platform; and, accuracy of implant impressions to allow accurate transfer of the implant(s) onto the masters casts [3,4].

An accurate impression is an essential factor for the precision of fit of these prostheses. Significant complications may occur as a result of inaccurate impression taking or of accurate impression taking with inappropriate placement of the analog(s) [5,6]. Inaccuracies between the implants in the oral cavity and in the analogs in the master cast may be due to vertical, horizontal and or rotational displacement of the impression coping inside the impression material [7,8]. During open tray impression taking, two steps may dislodge the impression coping inside the impression material: 1) when unscrewing the impression coping screw from the implant, in order for the impression to be removed from the oral cavity; and, 2) when screwing the implant analog to the impression coping after the impression is removed from the oral cavity. This may occur due to lack of retention of the impression coping and lack of stability of the impression material [7-11]. These disadvantages are more pronounced in single-unit rehabilitations; unlike in multi-unit impressions when all implants can be splinted, increasing the stability of the impression copings inside the impression material [6,12,13].

In single-unit rehabilitations, artifices may be incorporated in the technique to minimize dislodgement of the impression copings, such as; modifying the impression coping surface by adding adhesive or by sandblasting [10-14], adding auto polymerizing acrylic resin inserts surrounding the impression copings and creating a buccal and palatal/lingual fin [9]. Another option for increasing retention is to splint the impression coping to the tray while the impression material is in the oral cavity [15].

Aiming at establishing accurate single-unit impressions, and a consequently accurate master cast, a modified open tray implant impression copings was developed with retention screws (MIICRS). This MIICRS is destined for use in implants presenting the external hexagon connection with regular diameter. The purpose of this study was to evaluate the perception of residents of two specialty fields in dentistry when performing implant impressions with a conventional impression coping with auto polymerizing acrylic retention (CICAAR) and the MIICRS on the level of difficulty, preference, efficiency and future practice.

Material and Methods

This study was approved by the Federal University of Santa Catarina Committee on Human Studies (Number 782.696). The participants of the study consisted of 25 Implant Dentistry and Prosthodontics residents from several Brazilian educational institutions in different states (2 in the South, 3 in the Southeast, 2 in the Midwest and 2 in the Northeast). Each

program director was given the task to select 1 to 3 residents to participate in this research study. Each resident was instructed to perform two impressions of the same implant on the same patient from the residency program. One impression was performed using CICAAR and a second impression was taken with a MIICRS (Figure 1).

This impression coping was idealized at the Center of Continuing Education and Research in Implant Dentistry (Centro de Ensino e Pesquisa em Implantes Dentários [CEPID]) in the department of Periodontology at the Federal University of Santa Catarina (Universidade Federal de Santa Catarina). The (MIC) was developed from the commercially available coping (Conexão Sistema de Próteses, São Paulo, SP, Brazil) with the partnership of Conexão Sistemas de Próteses company. Six perforations were made on the impression coping's lateral wall, located in the mid-third of the coping's length. These perforations were for the insertion of 5 mm long screws. The design of the MIC eliminates the need for additional retention methods. The retention screws were developed such that the border of the thread does not reach the transfer work screw. This method requires insertion of two retention screws in positions where they do not touch the neighboring teeth. This method replaces the need for altering the impression coping with acrylic resin (Figure 2). The purpose of this modification is to increase the transfer coping's stability within the impression material, which has been a common problem associated with traditional open tray impression copings. In addition, this improved design allows for a more retentive impression coping, while decreasing chair-side work time.



Figure 1: A: Conventional open tray transfer impression coping, B: Conventional transfer with acrylic resin, C: Modified impression coping.

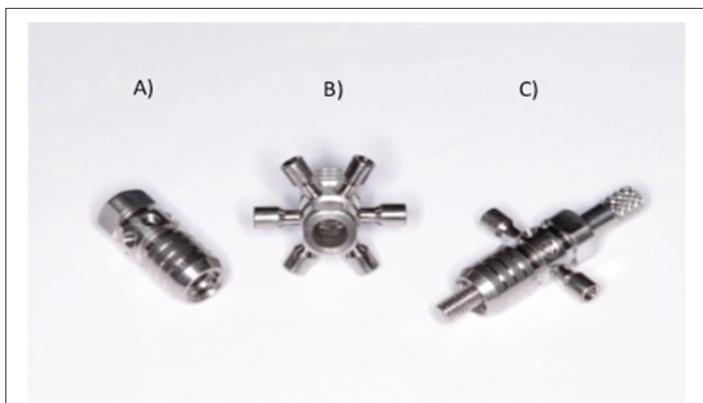


Figure 2: A: External hexagon implant modified open tray impression coping without lateral screws, B: With 6 lateral screws, C: With 2 lateral screws positioned for additional retentions.

All the impressions were performed using the open tray impression technique following the manufacturer's recommendations for the ideal impression material. The material to be used for impressions was not evaluated as part of this study. A previous study conducted this evaluation [16].

Perception

A validated visual analog scale (VAS) questionnaire was adapted to this research in order to investigate the residents' perceptions on the level of difficulty, preference, efficiency and future use of the MICs [17]. Participants were asked to draw a vertical line on a non-numerical 100 mm line relative to his or her perception of each category. A line made over the number zero (0) indicated that there wasn't any difficulty to perform the impression. A line drawn over the number 100 indicated that the technique was very difficult.

Level of difficulty, preference and efficiency

The residents classified the difficulty levels of the impression techniques, their preference to the two techniques and their perception of the technique's efficiency for each type of impression coping used; 1) the MIICRS; and, the CICAAR. In addition, they rated if the MIICRS technique would ultimately replace the conventional technique used in their future practice.

The results obtained from the questionnaires were converted into a numerical format and submitted to statistical analysis by the Wilcoxon test.

Results

On a 0 to 100 VAS, the residents of both specialty fields in dentistry scored a mean difficulty level of 43.74 (standard deviation [SD] \pm 23.31) for the impression with the CICAAR and 20,79 (\pm 23.66) with the MIICRS.

From the 25 residents, 88% regarded the difficulty level of the impression with the MIICRS less than with the CICAAR, being statistically different ($p < 0.05$) (Figure 3).

The residents' preferences were 88% for the MIICRS versus 12% for the CICAAR technique (Figure 4).

The residents' perceptions of technique efficiency were 92% more efficient technique when using the MIICRS versus 8% efficiency when using the CICAAR (Figure 5).

The residents' perceptions of future replacement of the conventional technique with the MIICRS technique were 16% would not replace the CICAAR technique by the MIICRS and 80% would replace the CICAAR technique with the MIICRS (Figure 6).

The results showed statistically significance ($p < 0.05$) for the analysis made of the residents' perceptions of difficulty level, preference, efficiency and possibility of the MIICRS overcomes the use of the CICAAR technique in the future.

Discussion

The limited use of dental implants presenting external hexagon connection was a limitation of this study. However, this study is current in the context that this type of connection is still commercially available and is still widely used. In addition, the proposed modifications to the impression copings may be valid for implants presenting other platform types for single unit prosthesis fabrication. The study participants were chosen at convenience due to the modified transfer not yet being patented. As the MIC is not yet being commercialized, a small number of impression copings were manufactured. All these factors limited the amount of participants in this research.

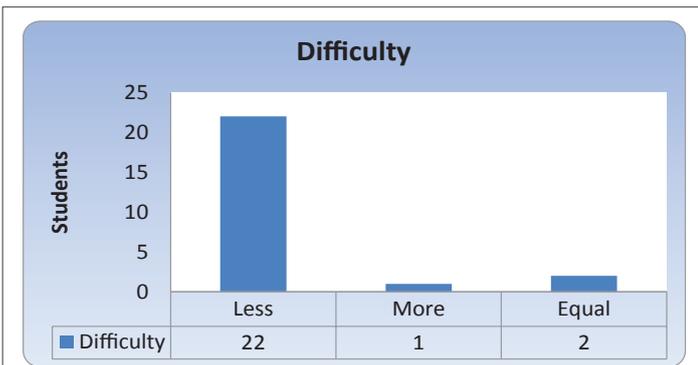


Figure 3: Degree of difficulty of the technique with modified transfer in relation to conventional.

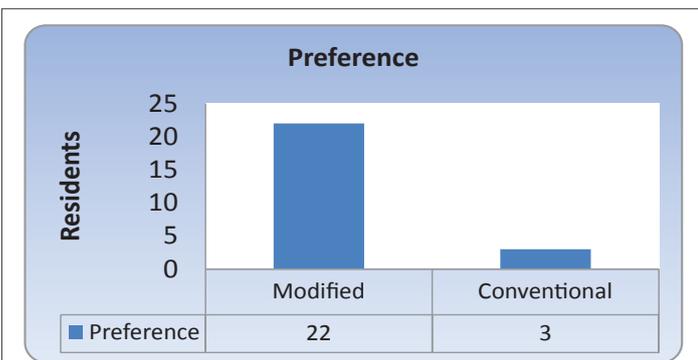


Figure 4: Graph showing residents preferences between the CICAAR and the MIICRS techniques.

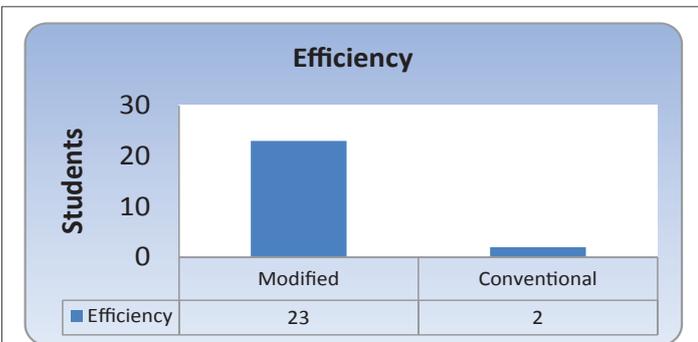


Figure 5: Residents perceptions to efficiency of techniques using both types of transfers.

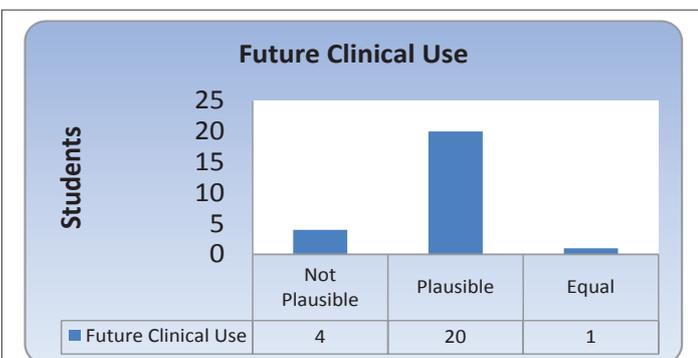


Figure 6: Graph showing possibility of future clinical use preference of the modified transfer technique over the conventional technique.

The results of Wilcoxon's statistical Test support rejecting the null hypothesis of equality in difficulty levels when performing an implant impression with CICAAR or MIICRSs. From the 25 participants 22 regard the MIICRS technique as being easier than the CICAAR technique.

Due to current clinician's familiarity using the CICAAR, the initial concern of the introduced MIICRS was the viability of it being incorporated into the modern dental practice. As they are typically used for implant dentistry, most clinicians are comfortable and familiar with conventional, traditional copings. This study shows that changing the routine with a modified tool may increase the clinician's ability to perform impressions in a manner that may increase accuracy and possibly reduce chair-side time with prosthetic adjustments or laboratory redos.

The difficulty level, efficiency and preference, of an implant impression taking technique using a MIICRS were investigated and compared to the conventional technique. The authors concluded that the MIICRS was easier, more efficient, preferred, and recommended to replace the conventional impression coping used in their practice.

The CEPID has ongoing studies on the accuracy of master casts obtained from impressions performed with conventional open tray impression coping, compared with the accuracy of impressions performed with: 1) a modified impression coping with two retention screws (MIICRS); 2) modified without the screws; and, 3) conventional impression coping with auto polymerizing acrylic retention (CICAAR). The results of the present study showed no statistical difference in the influence, of the MIICRS, in the accuracy of single external hexagon implants impressions when compared with the CICAAR technique. However, MIICRSs have shown to improve the position of the implant analog in the master cast fabricated from impressions taken with the MIICRSs [16] suggesting that the efficiency is the same as in the CICAAR technique. In the present study, the residents classified the MIICRS technique as being easier, mainly by technical facility, requiring no additional retentive features. In addition, they indicated it to reduce chair-side time for the practitioner. Even though the residents were not familiar with the new impression coping, they considered the MIICRS to be user friendly. The results confirmed that the MIICRS could be successfully integrated into the clinical practice.

From the outcome of participants' perception on preference, the residents preferred the MIICRS significantly to the CICAAR. From the efficiency outcome, the residents chose the MIICRS as the most efficient. Unlike the CICAAR, which needs clinician time and ability to create additional retentive features, the MIICRS can be used without having a great amount of experience and training. Due to reduced chair-side time, less need for modifications and adjustments of the single-units, in order to the reduce movement of the CICAAR in the impression material; the participants reported that the new transfer is able to overcome the conventional technique in the dental practice.

For a period of a year, the Implant Dentistry Masters and PhD residents of Federal University of Santa Catarina, have been making significant use of the MIICRS, which has shown to reduce the number of repetition of single-unit prostheses.

Conclusions

The perception of the participants of this study is that the MIICRS was more efficient and user friendly for the operator when compared with the CICAAR technique. The participants preferred the MIICRS and perceived it to be more frequently employed in their practice.

Author's Contributions

Dr. Morsch: Contributed substantially to this study's concept/design, data analysis/interpretation, drafting article, data collection & the clinical protocol.

Dr. Mariane Cardoso: Contributed substantially to this study's concept/design, data analysis/interpretation, drafting article, data collection & the clinical protocol.

Dr. Antonio C. Cardoso: Contributed to the critical revision of article, data analysis and statistics.

Dr. Ferreira: Contributed substantially to this study's data analysis/interpretation, drafting article and critical revision of article.

Conflict of Interest

The authors of this study do not have any conflict of interest.

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