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Evaluation of the effect of different complete denture impression techniques on dental anxiety levels

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Abstract

Background: There are several different impression materials and techniques utilized in the fabrication of complete dentures.

Aim of the study: To determine the anxiety levels and the clinical procedure time for maxillary completely edentulous patients by the use of two different impression techniques; the use of a low-fusing green stick compound along with zinc oxide eugenol impression paste and addition silicone (polyvinyl siloxane) along with light body material.

Materials and Methods: Twelve maxillary edentulous subjects aged between 44 and 68 were randomly recruited for the study. After having the primary impression two special trays were fabricated for each patient; the first tray for the sectional border moulding group using impression compound along with ZOE final impression material (Group Z), and the second tray for the single-step border moulding technique using additional polyvinyl siloxane impression along with light body final impression materials (Group P). Comparisons between the two groups' procedure time and patients' visual analog scale (VAS) levels were made.

Results: The results showed that group P had significantly reduced the VAS compared to group Z 17.5 ± 12.88 and 57.5 ± 16.03 , respectively ($P=0.000$). The mean total procedure times for single-step border moulding and sectional border moulding impression techniques were 12.25 ± 5.16 and 27.5 ± 4.00 , respectively ($P=0.000$). Also, a significant association between the treatment groups and VAS scores was observed by the multiple regression analysis model ($P=0.000$).

Conclusion: As a result of the better patients' perceptions and reduced clinical time, the study findings suggested using a single-step border moulding technique in the upper arch together with additional vinyl silicon material.

Keywords: denture, complete, impression technique, perception.

INTRODUCTION

Making an impression is one of the fundamental and crucial aspects of clinical prosthodontic practice. The purpose of the impression is to create accurate positive castings or positive forms of the recorded tissues used to create prostheses¹. Various impression materials are employed in the production of complete dentures, which are utilized to assure the accuracy of the impressions made and the methods employed in making them². Additionally, there are many impression procedures based on the force applied, the position in the mouth during the impression process, and also based on the manipulation technique for border moulding³. The patient's perceived burdens vary depending on the impression material and on the several procedures involved in generating an impression, thus clinicians choose among various materials and techniques and select the most affordable and comfortable technique for the patient⁴.

The most popular material for complete denture wash impressions is zinc oxide eugenol (ZOE) impression paste because it is inexpensive, simple to use, and advantageous for capturing even the smallest details of tissue⁵.

Because of their free-flowing nature, accuracy in recording tissue details, and dimensional stability, ZOE impression pastes, which have been available to the profession since the 1930s, are the most frequently used impression material for creating the final impression of completely edentulous ridges^{1,6}. However, conventional ZOE impression pastes could cause anxiety and nausea to patients⁷ and sometimes allergy⁸.

Over the past ten years, numerous researchers have suggested switching out older, more conventional materials for newer, elastomeric ones such as polyvinylsiloxane and polyether for final impressions⁹. Final impressions can be made using the elastomeric impression materials vinyl polysiloxane, silicone, and polyether¹⁰. For indirect restorations, such as crowns, veneers, inlays, onlays, implant-supported restorations, and removable partial and

complete dentures, polyvinyl siloxane (PVS) impression materials have become one of the most popular materials^{11,12}. Moreover, the success of a complete denture depends on proper peripheral extension and accurate recording of tissue features in the final impression. The finished and polished denture foundation should be simulated by the denture base borders of a final impression. The biological component known as the "border seal" includes close contact between the edges of the denture and the surrounding soft tissues¹³. Since 1907, border moulding impression trays have been made of impression modeling plastic; however, this material has some restrictions. Polyvinyl siloxane putty has recently been advocated as a replacement for the traditional technique, which involved moulding boundaries with modeling compound, because of its optimal physical characteristics, simplicity, precision, and convenient for both patients and dental professionals¹⁴. Additionally, using polyvinylsiloxane and a simultaneous border moulding technique rather than the more traditional method of using a low-fusing impression compound and sectional border moulding led to an increase in the retention of denture bases and a reduction in the amount of time required for manipulation^{15,16}.

Patients preferred the experience of having impressions for dentures taken in silicone and generally, they found silicone impressions to be more comfortable. Furthermore, after wearing dentures created from silicone impressions, patients' quality of life concerning their oral health improved, and patients enjoyed the process of having impressions taken, finding silicone impressions more comfortable¹⁷. Due to the lower number of tray insertions, single-step border moulding is significantly simpler than sectional border moulding. The time-consuming nature of the sectional technique and the difficulty in controlling it due to the limited manipulation duration of the impression compound modeling plastic are

frequent issues. The advantages of single-step border moulding include the reduction in the number of tray insertions required and the prevention of defect propagation by developing all borders at once¹⁸. Therefore, patients' levels of anxiety during complete denture fabrication could be reduced by using simpler single-step border moulding rather than sectional border moulding techniques. However, no previous studies have examined the relationship between the length of the procedure and the level of patient anxiety during making an impression on complete denture wearers.

This study aimed to compare the usage of polyvinyl siloxane addition silicone border moulding along with the addition of light body final impression to the low-fusing green stick compound border moulding along with zinc oxide eugenol final impression paste in terms of the levels of anxiety experienced by complete denture patients and the procedure time.

MATERIALS AND METHODS

Fifteen subjects who participated in the study were randomly chosen, all of them had come to the clinic since they needed new upper complete dentures for prosthodontic restoration. Only 12 patients were recruited for the study due to tissue undercuts, bony exostoses, and tori, which are considered exclusion criteria. For all procedures involving human participants, the ethical guidelines specified in the Helsinki statement of 1964 were observed. After receiving their consent, all participants' consent was obtained after they had been thoroughly told about all the procedures utilized in the study.

To create the primary impressions of the upper arch, a suitable stock tray and thermoplastic red impression compound material (Hoffmann, Germany) were used. Dental plaster was then poured over the first impression to create the primary cast. These casts made it possible to create two individual impression trays for each patient using acrylic resin that had been light-cured.

Depending on the material used for the final impression, the trays of each participant were divided into two groups. Group Z had border moulding formed of green stick impression compound (Hoffmann Dental Manufactur Gmbtt/D-144193 Berlin/Germany) with ZOE material (Impression past/S.S. white group, C/O Prima Dental Group/Stephenson Drive, Gloucester.GL2HA/England) used for the final impression. Group P had final impressions made of light body material cartridge (9Aquasil Ultra/Type3 Light bodied consistency. ISO 4823/Smart wetting impression material/Dentsply) and border moulding made of additional vinyl silicone impression material (vinyl silicon impression material, Bisco/Johnnes werk str.333611 Bielefeld North Rhine-Westphalia/ Germany), (Fig. 1). All materials were used following the manufacturer's instructions.

The duration of the process was divided into two sections and measured in minutes. For the initial preparation, the timer started when the dentist began using a green stick impression compound for the sectional border moulding technique or additional vinyl silicon impression for the single-step border moulding technique, and it ended right before the mixing of the final impression material. The timer was set for the second period when the dentist began mixing the final impression using additional vinyl silicon impression for the single-step border moulding (group P) or ZOE material for the sectional border moulding (group Z) procedures until the impression had been removed from the patient mouth. The sum of both times is considered as the total procedure time.

A Visual Analogue Scale (VAS) was utilized as a numerical rating scale to determine the patient's response regarding different impression techniques. The patients' ratings ranged from "not at all uncomfortable = 0" to "extremely uncomfortable = 100" on a non-numerical

100 mm line. Each response was assigned a number between 0 and 100¹⁹.

All data generated were subjected to analyses using the Statistical Package for Social Science (SPSS; Version 20; IBM Corp., Armonk, NY, USA). The Shapiro-Wilk test was applied to determine the degree of normality in the data. The T-test was used to analyze the differences between the mean values obtained for the VAS and the processing time for each treatment group, with a p-value of less than 0.05 designating a statistically significant difference. A multivariate regression analysis was employed to establish the association of the VAS as a dependent variable with the treatment groups and the processing time as predictor variables.

RESULTS

Twelve participants, aged between 44 and 68 years, were represented by 7 males and 5 females (n=12). Regarding demographic data analyses, there were no significant differences indicated between individuals as presented in Table 1.

The evaluation of the clinical outcomes for both impression techniques is shown in Table 2. The mean overall scores of the VAS were significantly higher for the group Z (57.5±16.03) compared to group P (17.5±12.88), which indicates a higher satisfaction level for the patients by using the single-step border moulding technique in the upper arch (VAS scores that are lower signify a better patient rating), (Fig. 2). Additionally, a longer clinical time was significantly observed when using the sectional border moulding technique for group Z (27.5±4.00) compared to the single-step border moulding technique for group P (12.25±5.16).

Although the single-step border moulding technique took less time than using the sectional border moulding technique, there was no association observed between procedure time and VAS (table 3). However, a significant association was

observed between the treatment groups and the VAS, in which group P reduced VAS by 55 units more than group Z, (table 3).

Conflicts of Interest

The authors confirm that there was no conflict of interest concerning the authorship and/or publication of this article.

DISCUSSION

Along with an extended life expectancy in the modern era, dentists have a greater need to provide patients who have lost all of their teeth for a variety of reasons with a high-quality prosthesis²⁰. As new materials and procedures have been developed, methods of making impressions have evolved. Today, a variety of materials and techniques are accessible for use in a variety of clinical settings, necessitating a thorough understanding of impression concepts and principles²¹.

Evidence suggests that there are observable variances in the final impression materials chosen in various geographical areas. In different survey studies conducted in South Asia countries in 2013 by Kakatkar²², and in 2018 by Bhochhibhoya et al,²³ they suggested recording the final impression in a cold-cure tray material with border moulding made of low-fusing compound and ZOE paste as a final impression material. The cost-effectiveness of ZOE and the variance in instruction and training in dental schools may be the causes of its preferential use in that region. While, in another survey study conducted in the United States in 2014 by Mehra et al,²⁴ they discussed the complete denture impression methods in their programs. They observed that modeling plastic impression compound was utilized by the majority of programs to border mould the special trays, and PVS was the material that was most frequently employed for the final impression. As there was no previous survey or data on impression material of choice in our region, the result of the current study

could be in line with the previous survey by Mehra et al,²⁴.

Visual Analogue Scale scores showed higher satisfaction levels for the patients by using the single-step border moulding technique in the upper arch than using the sectional border moulding technique. In the lack of definite outcomes preferring the traditional technique, the overall recommendation of complex and tedious techniques as a standard of care is in doubt²⁵. Therefore, we believed that the patients accepted the single-step border moulding technique in the upper arch as a simple procedure. Also, it could be more related to the type of impression materials used. In this study, ZOE and PVS impression materials were used with the sectional and single-step border moulding techniques, respectively. Due to an increase in the number of insertions that make the sectional border moulding process tiresome, inaccurate, and challenging over time, it has shown to be comfortless²⁶. While using a single-step border moulding technique, the number of tray insertions for border moulding might be reduced and faults caused by a mistake in one region affecting the border contours in another region are prevented from propagation because all borders are developed at the same time. Also, when using the green stick impression compound, there is concern that the heat used to soften the compound will burn the soft intraoral tissues, especially if the operator is inexperienced²⁷. Moreover, ZOE impression material could cause cutaneous or mucosal irritation²⁸.

The duration of the process in the following study was measured from the initial preparation, through the mixing of the final impression material, and it ended when the impression was removed from the patient mouth. It is more realistic to measure the working time for the entire procedure than to measure the setting time of impression materials. It was clear from the finding of the following study that the use of the single-step border moulding required less time than the sectional border moulding techniques. Similarly, de Resende et al, 2019²⁹ indicated

that when compared to the conventional final impression procedure, the alternative method is less time-consuming and produces equal clinical results. Findings imply that this alternative might be taken into account when the effectiveness of healthcare services is a top priority. Each dentist can easily manipulate silicone impression material because of its superior elasticity, tolerable working time, good dimensional stability, acceptable flavour, and ease of use. Furthermore, low fusing compounds have a short manipulation time, harden quickly in the mouth, and do not remain in a plastic stage until the functional movements are completed, necessitating more insertions and taking a longer time³⁰. Therefore, it was shown that patients preferred dentures created from silicone impressions³¹.

In this study, we examined the association between VAS scores and other predictor factors such as treatment groups and the duration of the process utilizing the linear regression analysis model. Group P as a predictor in this study reduced VAS scores more than group Z. However, there was no association between time and VAS scores. Complete dentures created using the traditional technique, which involved making an initial alginate impression in a stock tray and a final silicone impression in a border-moulded custom tray were observed to have higher overall patient satisfaction³². Although there were no previous studies analyzing the association between procedure time and VAS, we believe satisfaction scores are a matter of patient preference and it is not related to the treatment itself. A previous systematic meta-analysis study conducted by Sivaramakrishnan et al, 2020³³, found that patient satisfaction was a major factor that may influence the choice of impression technique. Although the time required is longer, there was a general preference for digital impressions³³.

The use of only one type of conventional impression material and technique—hand mixing—was one of the study's limitations. Additionally, by altering the product type of

the impression materials and the mixing technique of the standard impressions, many comparisons might be made. Although impression materials and techniques constrained this study, we thought that using the same supplies we used in our daily practice would be more practical. Additionally, due to time and resource limitations, the study did not compare the previous methods with the digital impression technique, however, it is recommended for future studies.

Conclusion

Within the limitations of this clinical study, it was concluded that the single-step border moulding technique reduced patient anxiety levels and procedure duration time more than the sectional border moulding technique. However, there was no association found between procedure duration time and patient anxiety levels, even though the single-step border moulding technique takes less time than the sectional border moulding technique.

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Table 1. Socio-demographic data of patients enrolled in the study.

Variables		N	Mean (SD)	P-value
Age	Male	7	60.29 (6.18)	0.331 [†]
	Female	5	54.80 (10.35)	
Gender	Male	7	41.7%	0.364 [‡]
	Female	5	58.3%	
	Total	12	100%	

*Significance at $p < 0.05$ using [†]Independent T-test and [‡]Chi-square test.

N – Number of individuals.

P – Probability value.

Table 2. Mean values of VAS scores and procedure time according to the treatment groups of all participants.

Variables	Group Z (N=12) Mean (SD)	Group P (N=12) Mean (SD)	P-value
VAS scores	57.5 (16.03)	17.5 (12.88)	0.000*, [†]
Procedure time (min)	27.5 (4.00)	12.25 (5.16)	0.000*, [†]

*Significance at $p < 0.05$ using [†]Independent T-test.

N – Number of individuals.

P – Probability value.

Table 3. Multivariate regression analysis to detect the association of the variation in VAS scores with treatment groups and procedure time as predictor variables.

Variables	VAS scores	
	Coefficient (SE) [†]	P-value
Intercept	83.972 (18.470)	0.000*
Groups [†]	-54.698 (11.553)	0.000*
Procedure time (min) [‡]	-0.961 (0.654)	0.156
R2	0.704	

[†] 0 = Group Z; 1 = Group P, [‡] Time in minutes, and [†] SE = Standard error.

* Indicates a significant difference between variables ($P < 0.05$).

P – Probability value.

R2 – R square.

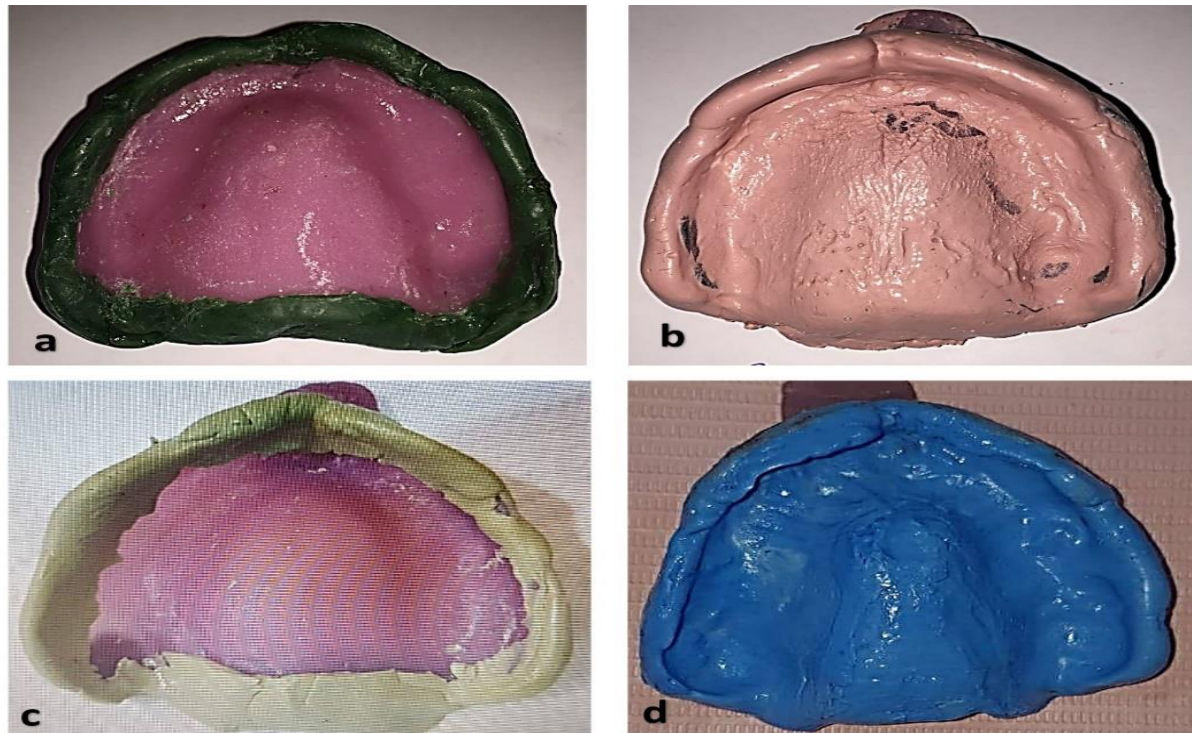


Figure.1 Final impression procedure: (a) green stick impression compound and (b) ZOE final impression for the sectional border moulding technique; (c) additional vinyl silicon impression and (d) light body final impression for the single-step border moulding technique.

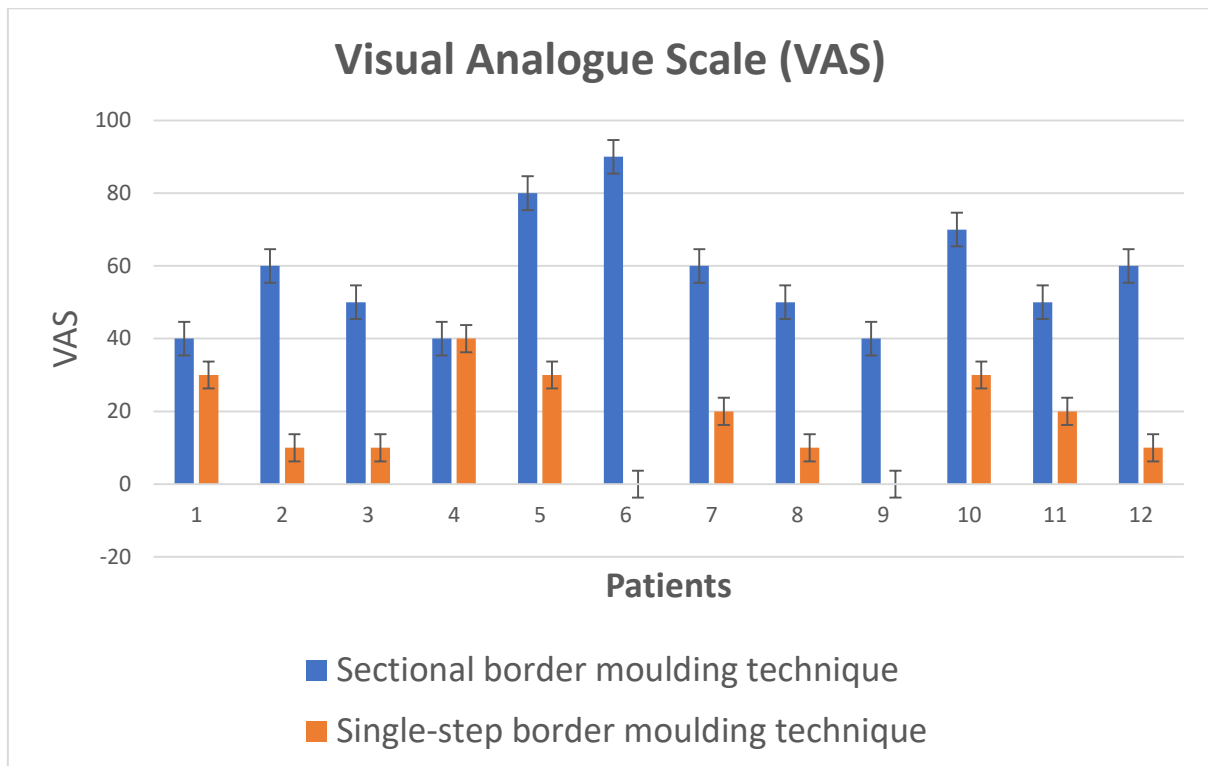


Figure. 2 Visual Analogue Scale (VAS) for the sectional and the single-step border moulding techniques (VAS scores that are lower signify a better patient rating).