



A pilot survey of impression materials and techniques used by dentists in the fabrication of fixed indirect restorations

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Abstract

Objective: To assess the choice of impression material and impression technique used by Nigerian dentists for the fabrication of cast restoration.

Method: A self administered questionnaire was distributed to dentists present at two national dental meeting held at Abuja and Lagos in 2011. The questionnaire assessed their choice of impression materials and technique.

Result: Fifty one out of 70 questionnaires were returned filled giving a response rate of 73%. There were 54.9% of the respondents who reported addition curing silicone impression as their first choice material for cast restorations, while 27.4% use alginate as first choice impression. The use of stock plastic trays by the respondents was significantly higher than metal and custom trays. Two-third of the respondents poured their impressions within one hour. All the respondents poured alginate impression after 15 minutes. A significantly high percentage (76%) of the respondents did not retract the free gingival before taking impression.

Conclusion: The use of alginate impressions to produce cast restorations was common among the respondents. Since no previous study has documented the use of alginate to produce accurate fitting cast restorations, there is need to investigate the accuracy of alginate impressions in a clinical setting.

Key words: Impression material, impression technique, impression tray

Introduction

Various combinations of impression materials, tray and technique are used in the fabrication of crowns and bridges. Each impression material and tray has its merits and demerits. The clinician should have an in depth knowledge of the material, tray and technique he has chosen and use the technique chosen in a way that that will not introduce error into the impression. An accurate and dimensionally stable impression, in a rigid tray is a prerequisite to achieving an accurately fitting crown or bridge⁽¹⁻⁴⁾. Poor impression technique will produce poor fitting restorations with marginal opening. Repetition of the impression procedure results in waste of material and time and patient dissatisfaction.

Previous studies confirmed that a rigid impression tray such as custom tray, metal tray and rigid plastic tray produce a more accurate impression compared with non rigid plastic trays^(1,4). Werrin conceived the double arch impression tray in 1979 and registered the design in 1980⁽⁵⁾. The double arch impression is a closed mouth impression technique which uses a dual arch tray to records the tooth preparation, opposing teeth, adjacent teeth and occlusal registration of the opposing teeth in a single impression tray. Thus it is also referred to as the triple tray technique. The advantages of this technique are savings in time and material, ease of use and patient comfort^(6,7). The disadvantage of the double arch tray is the absence of contra lateral teeth which may lead to incorporation of

eccentric occlusal interferences in the final restoration. Addition silicone and polyether impression materials have been documented as the most accurate and dimensionally stable of all the impression materials available⁽⁸⁾. Other elastomeric impression materials that can be used for crowns and bridges are condensation curing silicone and poly sulphide. They are accurate but dimensionally stable for a short period of time because it gives off by-products such as water and ethyl alcohol during polymerisation. Alginate hydrocolloid is an elastic impression material which is cheap and readily available in the market. Alginate is not dimensionally stable when set, it is not rigid as the elastomeric impressions. It shrinks or absorbs water depending on the humidity of the atmosphere. Therefore alginate is mainly used to make study models⁽⁹⁾. Its use for crown and bridge work is not documented in literature. Laboratory studies of a new type of alginate presented as a tray and syringe alginate reported that alginate can be used for crown and bridge work if it is poured within ten minutes⁽¹⁰⁾.

The purpose of this study is to determine whether dentists are using appropriate impression material and techniques for fabrication of crowns and bridges. The result will further strengthen the undergraduate and continuing dental education programs in fixed prosthodontics.

Materials and method

Self administered questionnaire were distributed to



dentists present at two national dental meeting held at Abuja and Lagos in 2011. The respondents were told not to fill the questionnaire if they had filled the questionnaire at the first meeting. The questionnaire assessed their choice of impression materials and techniques. The location of respondents practice, use of gingival retraction, pouring time of impressions, personnel responsible for pouring of impression and marking of finish line on the die were requested on the questionnaire. The data analysis was performed using the Statistical Package for Social Sciences software version 11 (SPSS, Chicago, Ill) and statistical significance between frequencies was evaluated with chi-square test at a significance level of $p < 0.05$.

Result

A total of 51 questionnaires were returned; a response rate of 73%. **Table 1** shows the distribution of the respondents by location of practice, with 54.9% of the dentists located in Lagos. Addition silicone was the most popular first choice of impression material for crown and bridge work followed by Alginate (**Figure 1**), while 64.7% of the respondents used plastic stock tray (**Table 2**) and 80% usefull arch trays (**Figure 2**). Only 20% of respondents used quadrant dual arch tray(triple tray). Seventy-six percent of the respondents did not retract the gingival before taking impression, 18% used epinephrine impregnated cord while 6% use aluminium chloride impregnated cord. Fifty-six percent of respondents used syringe to place the light body impression material on the tooth, 86% reported that their impressions were poured by the technologist. Only 8% of dentists poured their impressions. **Table 3** shows the pouring times of the impressions as reported by the respondents

Table 1. Percentage distribution of respondents by location of practice

Location of dental practice	Number of respondents (%)
Abuja	2 (3.9)
Edo	3 (5.9)
Kaduna	1 (2)
Lagos	28(54.9)
Osun	4 (7.8)
Oyo	9 (17.6)
Plateau	1 (2)
Rivers	3 (5.9)
Total	51 (100)

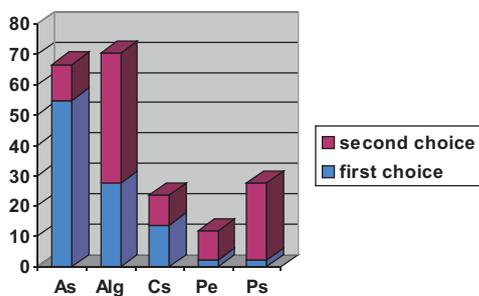


Figure 1. Percentages of dentists who used various impression materials as their primary and second choices (As Addition silicone, Alg Alginate Cs Condensation silicone, Pe Polyether, Ps Polysulphide)

Table 2. Respondents' choice of impression tray by location of practice

Tray type	Abuja n (%)	Edo n (%)	Kadun n (%)	Lagos n (%)	Osun n (%)	Oyo n (%)	Plateau n (%)	Rivers n (%)	Total n (%)
Metal	0	0	0	2(7.1)	3(7.5)	8(88.9)	1(100)	1(33.3)	15(29.4)
Plastic	1(50)	2(66.7)	1(100)	26(92.1)	1(25)	1(11.1)	0	1(33.3)	33(64.7)
custom	1(50)	1(33.3)	0	0	0	0	0	1(33.3)	3(5.9)
Total	2(100)	3(100)	1(100)	2(100)	4(100)	9(100)	1(100)	3(100)	51(100)

$\chi^2 = 7.50$ $df = 14$ $p < 0.001$

There is significant difference in the choice of impression tray among dentists in different states ($P < 0.001$)

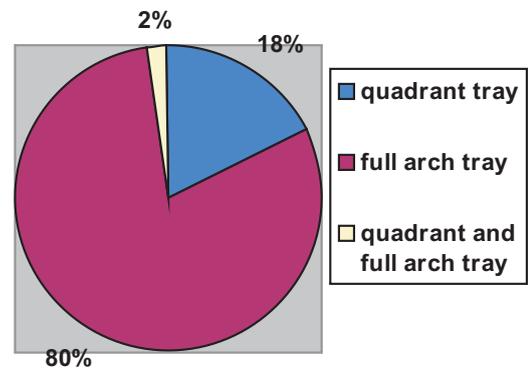


Figure 2. Percentage of dentists who use quadrant or full arch tray or both

Table 3. Pouring times of impressions by dentists according to their primary choice of impression material

Pouring time of impression	Addition Silicone	Alginate	Condensation Silicone	Polyether	Poly Sulphide	Total	%
Immediately	1 (3.6)	0	0	0	0	1	(2)
15-30 min	7 (25)	6 (42.9)	3 (42.9)	1 (100)	0	17	(33.3)
30min-1hr	9 (32.1)	3 (21.4)	3(42.9)	0	1(100)	16	(31.4)
1-4 hrs	5 (17.9)	2 (14.3)	1(14.2)	0	0	8	(15.7)
4-8 hrs	2 (7.1)	2 (14.3)	0	0	0	4	(7.8)
8-24hrs	3 (10.7)	1 (7.1)	0	0	0	4	(7.8)
24-72 hrs	1 (3.6)	0	0	0	0	1	(2)
Total	28(100)	14(100)	7(100)	1(100)	1(100)	51	(100)

$\chi^2 = 4.02$ $df = 24$ $p < 0.001$

Significant association between impression material and pouring time i.e. pouring time was significantly influenced by type of impression material ($p < 0.001$)

Discussion

The use of rigid impression tray, dimensionally accurate impression material, pouring of impression within recommended time and gingival retraction to expose the finish line are factors necessary for production of accurate casts for crown and bridge restorations(4,8,9).



Choice of impression material

This study shows that 54.9% of the respondents used addition silicone as first choice impression material for crown and bridge restoration followed by alginate (27.4%), condensation silicone, polyether and polysulphide. All the impression material except alginate has been documented to produce accurate crown and bridge restorations if the correct impression technique is used and impression poured within recommended time^(4,8).

Alginate is a popular second choice of impression material. This may be attributed to low cost of alginate. The use of alginate for crown and bridge work is not supported in the literature because it is not rigid and it is dimensionally unstable. It either loses water by syneresis to the atmosphere or absorbs water by imbibition depending on the humidity of the environment. Alginate impression should be given to an assistant to pour immediately it is removed from the mouth to ensure accuracy of the cast produced⁽¹¹⁾.

Choice of impression tray

Studies have shown that custom tray produce the most accurate casts because of its rigidity and close adaptation to the teeth which produce a uniform thickness of impression^(1,12,13). However time and expense of fabrication of the custom tray are major drawbacks to its use. In the present study only 5.9% of the respondents reported the use of custom tray. This is similar to other studies that reported less frequent use of custom trays in clinical practice⁽¹⁴⁻¹⁶⁾. Rigid plastic trays and metal trays have been shown to produce accurate cast that can be used to produce crowns and bridges which fit accurately⁽¹⁷⁾. In the present study 64.7% and 29.4% of respondents used full arch plastic trays and metallic trays respectively. There is a significant difference in the choice of impression tray by dentists in the different states represented. The use of dual arch tray also known as triple tray was reported by only 20% of the respondents despite the availability of the dual arch tray at the major dental suppliers in Nigeria. This may be attributed to lack of undergraduate training in the clinical use of dual arch trays. This is in contrast to a previous study that reported that 73.1% of impressions sent to the laboratory for crown and bridge fabrication was taken with the dual arch tray⁽¹⁶⁾. The dual arch impression has been reported to be accurate for single crowns and short span bridges⁽¹⁸⁾. The dual arch technique has the advantage of being faster, cheaper and more comfortable than the full arch tray technique⁽¹⁶⁾.

Gingival retraction

Most of the respondents (76%) reported that they do not retract the gingiva before taking an impression of the prepared tooth. Gingival retraction should be done before taking an impression of a prepared tooth to ensure the finish line (which is usually placed at the gingival margin or about 0.5mm sub-gingivally) is exposed and well represented on the impression. Gingival retraction can be achieved by mechanical or surgical means. Mechanical retraction is achieved by placement of a cord impregnated with a chemical agent such as aluminium chloride, epinerphrine or ferric sulphate sub gingivally⁽¹⁹⁾. This shrinks the gingival tissues and exposes the finish line. Surgical gingival tissue removal can be accomplished by excision with a scalpel or electrosurgery⁽¹⁹⁾.

Pouring times of impression

The present study shows that there is a significant association between impression material used by dentists and pouring time of the impression. Addition silicone has been reported to be the most accurate and dimensionally stable impression material^(4,8,20, 21). Addition silicone and poly ether are dimensionally stable and can be stored for up to 24 hours before pouring. Polysulphide and condensation silicone impression are only accurate for up to 2 hours and should be poured within 2 hours to ensure accuracy. This present study shows that impressions for fixed prosthodontics are mostly (86%) poured by the technologist. If an elastomeric impression material is used, pouring of the impression may be delayed till it gets to the technologist. Alginate is dimensionally unstable and there is no documented study to support its use for taking impression for crown and bridge restorations. Previous studies reported a combined system of alginate and reversible hydrocolloid impression for crowns to eliminate the disadvantage of both materials when used individually^(22,23). In order to obtain an accurate cast from an alginate impression, it has to be poured immediately or within ten minutes of taking the impression^(10,11). In the present study, 6 out of 14 respondents that chose alginate as first choice impression material poured their impression between 15 and 30 minutes while the remaining 8 poured their alginate impressions at various times after 30 minutes (**Table 4**). This shows that their restorations may not fit accurately because of dimensional changes in alginate impression after 10 minutes. A well fitted crown must be well adapted to the finish line of the prepared tooth. The marginal gap between the tooth and restoration should be less than 100 microns and undetectable visually⁽²⁴⁾. The marginal gap should not accommodate the tip of an explorer which is about 80- 100 microns. A previous study compared the accuracy of alginate with elastomeric impression materials and reported that alginate produced marginal gap that varied between 44 and 188 microns while the elastomeric impression produced marginal gap of 39 to 130 microns⁽²⁴⁾. The present study shows that 27.4% of the respondents used alginate as first choice impression material for fixed prosthodontics and 43.1 % used alginate as a second choice. There is no literature to show that alginate produces accurately fitting crowns and bridges. Therefore there is need for a clinical study to assess the accuracy of alginate in fixed prosthodontics.

Conclusion

The use of dual arch tray is not popular with the respondents in this study and the majority (64.7%) used plastic impression trays while 54.9% of the respondents used addition silicone impression material for fixed prosthodontics. However the use of alginate impressions as first and second choice was common among the respondents. Since no previous study has documented the use of alginate to produce accurate fitting cast restorations, there is need to investigate the accuracy of alginate impressions for fixed prosthodontics in a clinical setting. Continuing dental education program should include Impression techniques for fixed prosthodontics, updates on new impression materials and techniques available and the proper handling of impression needs to be taught and demonstrated clinically during undergraduate training.

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