Original Article

Efficacy of silicone as a dowel impression material

Howlader TB[1], Alam MK[2] , Sultana A[3]

Abstract

Background: Different types of impression materials and different procedures or methods have been introduced in Dentistry for preparing dowel crown. ***Materials and Methods:*** Injection technique with silicone impression materials are being extensively used by the materials to get an accurate impression. But whether this material neither ensures similar accuracy nor produces absolute accuracy. This study evaluate silicone impression material was efficient enough to produce nearest to actual intraradicular surface reproduction by assessing the void formation and dimensional accuracy. ***Conclusion:***By assessing all the parameters the silicone impression material was proved to be the efficient for intraradicular surface reproduction.

Keywords: Silicone impression materials, injection technique, intraradicular surface, dowel space.

Introduction

Reproduction of dowel space intra-radicular anatomy is essential to produce a dowel which is needed to produce a cast core. A cast dowel post and core system consists of a post and a core. A core is defined as "the part of a preparation for an indirect restoration consisting of restorative material". The post is the part of the preparation that is inserted in to the prepared root canal of a tooth. Appropriate endodontic treatment and subsequent coronal restoration to teeth that were once thought of as "hopeless" or "lost" may contribute to improving aesthetics, function and maintaining the stability of the dental archea[1].

The use of endodontically treated teeth as abutments for fixed or removable prosthesis has provided successful clinical results over time[2]. Reproduction of cast dowel-core patterns can be taken either by direct technique or indirect technique[3-4]. An impression that does not produce proper reproduction of the radicular surface anatomy will have to be discarded and a remake of the impression will have to be taken. This causes the waste of valuable chair side time for the dentist and also may be an annoyance to the patient[5].

Among the materials used for taking reproduction of the dowel space silicone impression material is commonly used. In recent literature, overcoming the drawbacks using the material while reproducing the intra-radicular surface anatomy has been described by using injection technique and supporting the impression with a post.

Various invitro study had been performed to reproduce dowel space intra radicular anatomy, to detect voids formation, size of the voids and their position but there may be no such type of in vivo study has been found in the literature.

Therefore, the purpose of this is study to evaluate and describe the efficiency of silicone impression material for dowel crown to know whether it provides better prognosis and higher success for reproduction of intra-radicular surface anatomy by using injection technique.

Materials and Methods

The observational in vivo study was conducted in the Department of Prosthodontics, Bangabandhu Sheikh Mujib Medical University, Shahbagh, Dhaka-1000, Bangladesh. The duration of study was from January 2006 to June 2008.

Study sample:

Twenty maxillary and mandibular teeth needed for dowel crown were selected to take the impression for post.

1. Tariq Hasan Howlader, Medical Officer, Department of Prosthodontics, BSMMU, Dhaka
2. Mohammad Khursheed Alam, Senior Lecturer, Orthodontic Unit, School of Dental Sciences, Health Campus, Universiti Sains Malaysia
3. Alia Sultana, Associate Professor and Chairman, Department of Prosthodontics, BSMMU, Dhaka

Corresponds to: Mohammad Khursheed Alam, Senior Lecturer, Orthodontic Unit School of Dental Sciences, Health Campus, Universiti Sains Malaysia, ***E-mail:*** dralam@gmail.com

Inclusion criteria:
Only badly broken down endodontically treated mandibular and maxillary anterior teeth.
Teeth containing only one canal.
Teeth with coronal tooth structure more than 2mm above the gingiva.
Teeth with good apical seal

Clinical procedure
All procedures were carried out by aseptic measures. Radiographs were taken of the teeth to see the adequacy of root canal filling.

The working lengths of the teeth were determined with the help of previous records and radiographs.

Axial and incisal reduction of 2.0mm were accomplished with a flat end tapered diamond. Labial reduction was done 2.0 mm deep axially. Lingual reduction was done with a small wheel diamond. All existing restorations, caries and thin or unsupported tooth structure was removed but preserve as much coronal tooth structure as possible, to enable the axial walls of the crown to externally brace the tooth. Measurement of a peeso reamer against a radiograph of the tooth being restored was done to determine the length to which the instrument will be inserted into the canal. A silicone rubber endodontic stop was slided onto the shank of the reamer, aligning it with a landmark such as the incisal edge of the adjacent tooth to ensure insertion of the instrument to the proper depth in the tooth. Isolation of the area by cotton rolls were done to prevent contamination of the canal and to protect nearby tissues. The canal was enlarged using the largest peeso reamer that will fit into the canal. The canals were enlarged according to the general guidelines for the final dowel diameter for the individual tooth requirement. The canals were enlarged sequentially until reaching the size that has been decided upon for that tooth (there should be a minimum thickness of 1.0mm of tooth structure around the dowel at midroot and beyond).
A no. 170 bur was used to make a keyway or groove (anti rotational groove) in the orifice of circular canals (approximately 0.6mm depth and 4 mm length) where the bulk of remaining tooth structure was the greatest.
A flame diamond was used to place a contrabevel around the external periphery of the preparation.

Plastic post selection
Plastic post patterns were selected that fits passively to the base of the prepared canal of the teeth. Light-bodied silicone (polysiloxane) impression material (Oranwash L, Zhermack, Italy) was manipulated according to the manufacturer's instruction. The light bodied silicone was inserted into the tube of a syringe (JIM-bangla co.ltd. disposable syringe) fitted with an 18 gauze needle (Doctor hypodermic needle, Japan) and the tube plug seated. The light bodied silicone was injected into the dowel space by introducing the tip of the needle to the bottom of the prepared dowel space and back-fill completely to the orifice of the dowel space. The post which had been previously thinly coated with an adhesive (Chalk Tray Adhesive, Dentsply) 15 minutes prior was inserted into the canal of the prepared length. The impression was allowed to polymerize for 6 minutes (Fig. 1 a-h). The impression was removed and evaluated under a magnifying loupe.

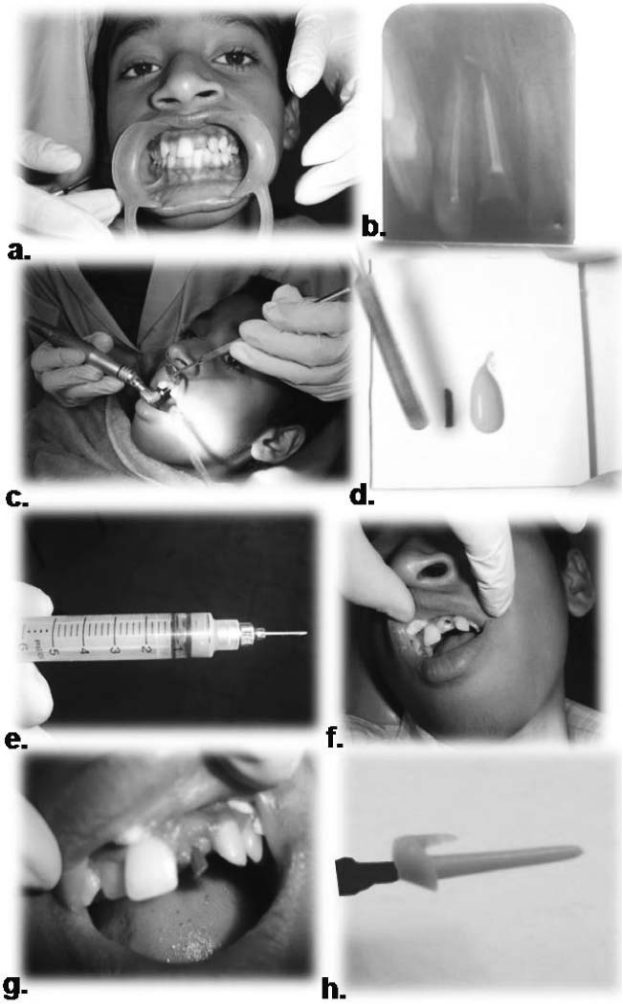

Figure 1(a-h): Procedure of dowel space pattern by light-bodied silicone.

Evaluation of voids
The impression of the dowel space of each tooth was

observed under a magnifying loupe with magnification of 4X (Lactona magnifying loupe, Japan) and evaluated for number, size, and location of voids along the length of the dowel impression. Data were collected and analyzed.

Results

Table I: Distribution of the study subjects by number of voids (n=20)

Voids	(n=20) No. (%)
Present	1(5)
Absent	19(95)

Table I shows the number of voids formation on silicone dowel impression. Out of 20, 1 impression was represent voids.

Table II: Distribution of study subject by size of voids (n=4)

Size of voids	No. (%)
<1 mm	1(14.28%)
>1 mm	0(00)

Table II shows the size of voids. Only 1 void was < 1 mm in size.

Table III: Distribution of the study subject by position of voids (n=4)

Voids on position	No. (%)
Apical 1/3rd	1(14.28%)
Middle 1/3rd	0(00)
Cervical 1/3rd	0(00)

Table III shows the position of voids on the impression. One void was found in the apical 1/3rd.

Discussion

During taking impression silicone was used as an impression material and injection technique was followed. This technique helped us to facilitate the free flow of the material into the tiniest dowel space and thus prevented the air trapping within the material. Chee et al.[6] used a reliable technique to insert impression material into the dowel space along with an injection needle to function as a vent to allow the escape of air that remained in the dowel space. When local anesthetic needle is used, it should be secured with dental floss to prevent accidental swallowing or aspiration by the patient. The technique used in this study omits need to use an injection needle as a vent, so it eliminates the chance of swallowing or aspiration of the needle by the patient. Furthermore the use of vents may be limited to silicone material only and might not be practical when used for acrylic resin and inlay casting wax.

Sherfuddin and Abdullah [7] showed that the method of injection has been started to produce void free casts using dental stone from vinyl polysiloxane impressions by controlling the rate of flow of material and filling the material from bottom to up.

This study was found that silicone impression material has shown the only 5% void formation, which demonstrates the efficacy of silicone as dowel impression material in regards of void formation.

TM & Ercoli[8], identified that the use of silicone as dowel impression material reduces the problem of void formation. Stackhouse FL[9] regarding the position and size of the voids, the voids produced from the impression by light body silicone were only in apical 1/3 rd and also of smaller size. Kim et al. (2001) identified that dimensional changes type of silicone impression materials was smaller than that of other type's impression materials[10].

According to the results silicone as dowel impression material has shown almost 100% efficacy and clinical evaluation has shown good results while making patterns in patients using this technique[11,12]. Varieties of silicone as dowel impression material other than that used in this study are available (GC Pattern resin, GC Corp, Tokyo, Japan) which have slightly different properties. Shrestha[13] with the same materials and methods silicone as dowel impression material has shown more or less similar result. According to the results silicone impression materials has shown superior efficacy.

However, clinical evaluation has shown good results while making patterns in patients using this technique[14,15].

Conclusion

Based on the reflection of this study light-bodied silicone is detected as an efficient intra-radicular surface reproduction of dowel space impression material in terms of number of voids, their position, size, as well as dimensional accuracy.

References:

1. Sivers JE, Johnson WT. Restoration of endodontically treated teeth. *Dent Clin North Am* 1992; **36**:631-50.PMid:1397429

2. Donovan TE, Chee WW. endodontically treated teeth:A summare of restorative concerns. *J Calif Dent Assoc* 1993;**21**:49-56.PMid:7514656

3. Shillingburg HT, Fisher DW & Dewhirst RB. 'Restoration of endodontically treated posterior teeth', *J Prosthet Dent*, 1970;**24**: 401-09. http://dx.doi.org/10.1016/0022-3913(70)90081-8

4. Trebilcock CE & Evans DB. A two-stage impression technique for the indirect fabrication of multiple cast dowel and cores. *J prosthet dent*, 1991; vol.**66**,pp.422-425.http://dx.doi.org/10.1016/0022-3913(91)90498-L

5. Hampson EL, Clark J. The post-Retained Crown, *Dent Pract Dent* Rec 1998;130-5.

6. Chee WWL, Cho GC, Marzola R. An in vitro comparision of 5 techniques for impressing Dowel space preparations, *J Prosthod* 2000;**9**:19-22.http://dx.doi.org/10.1111/j.1532-849X.2000.00019.xPMid:11074024

7. Sherfudehin H, Abdullal MA. Preparation of void- free casts from vinyl Polysiloxane impressions, *J Dent* 1996;**24(1-2)**: 95-98. http://dx.doi.org/10.1016/0300-5712(95)00049-6

8. Hofstede TM, Ercoli C. An indirect technique for fabrication of a post and core wax pattern, *J Prosthet* Dent 2002;**87**:341-2.http://dx.doi.org/10.1067/mpr.2002.120841 PMid:11941366

9. Furst L, Stack HJ. Voids in impression elastomers. *J Dent Res.* 1982; **61**:262

10. Kim KM, Lee JS, Kim KN, Shin SW. Dimensional changes of dental impression materials, *J Biomed Mat Res* 2001; **58**:217-20. http://dx.doi.org/10.1002/1097-4636(2001)58:3<217::AID-JBM1010>3.0.CO;2-V

11. Furst L, Stack HJ. Voids in impression elastomers. J Dent Res. 1982; 61:262

12. Heilman IV. A simplified pattern for a cast metal post, *Journal Am Dent Assoc* 1998;129:223. PMid:9495056

13. Shrestha P. An in vitro comparative study of three different materials for reproduction of intra-radicular surface using injection technique, BSMMU [thesis] 2008; pp 46.

14. Heilman IV. A simplified pattern for a cast metal post, *Journal Am Dent Assoc* 1998;129:223. PMid:9495056

15. Schelb E. Using a syringe to made void free cast from elastomeric impression. *J Posther dent* 1988;**60**:121-22.