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Original Article

Dentistry Section

Hinged Single Piece Putty Index for Preclinical Demonstration of Tooth Preparation for Fixed Partial Dentures and Crowns

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ABSTRACT

Introduction: Different types of indices are being used for assessment of tooth preparation. All these indices are used to visualize tooth preparations in a particular plane. A single versatile index which could help to visualize tooth preparations in different planes is non-existent. The need for fabrication of such an index and its reliability is of utmost important to provide quality tooth preparations.

Purpose: The purpose of the study is to fabricate a hinged single piece sectioned index which could be used to visualize tooth preparation in different planes and check its reliability in-vitro on phantom models.

Materials and Methods: Ten preclinical students were selected in random for preparing three teeth each. The three teeth preparations are classified as Group A, Group B and Group C based on the non-usage of index, usage of sectioned index and hinged single piece sectioned index respectively. Students were made to do provisional restorations after the tooth preparations. Then a questionnaire was given to students to score the duration/accuracy/comfort during tooth preparation and duration/accuracy of provisional restorations for each of the Groups A,B and C.

Results: In Group C, 90% of students found the final preparation to be very accurate. The time taken for fabrication of provisional restoration using sectioned hinged index by 60% of Group C students was 20 to 30 min.

Conclusion: This hinged index is a viable option when accuracy of tooth preparation and speedy fabrication of provisional restoration is required.

Keywords: Accuracy, Fabrication, Restoration

INTRODUCTION

Silicone indices are commonly used to help in tooth preparation and evaluate the extent of tooth preparation. Many types of indices are available; few among them are wrap around sagittal section index, cross sectional index [1,2]. Some authors have also used depth gauge bur and vacuum formed thermoplastic matrix for tooth reduction [3,4]. Few of them have extensively studied the principles of tooth reduction which has evolved over the years and have concluded that the non-usage of index of any kind resulted in more errors during the tooth preparation. It is interesting to note that all the indices which dentists have used over the years were used to visualize tooth preparations in 2 planes only and they cannot be used to assess tooth preparation simultaneously in all planes namely occlusal, proximal, buccal, lingual and finish margins. This is because of the fact that these indices are separate entities and they could not be used together simultaneously [5,6]. There is not a single index which will comprehensively help us to visualize tooth preparations in different planes as well as help us in fabrication of provisional restorations after tooth preparation. Hence, a new putty index is required and in the following article a new technique of fabricating a putty index is elaborated together with an in vitro study to check its pros and cons in usage.

MATERIALS AND METHODS

This study was done in Preclinical phantom lab section, Department of Prosthodontics, College of dentistry, King Khalid University, Abha, Kingdom of Saudi Arabia. Prior to starting of the study, permission was obtained from the ethical approval committee of the institution keeping in mind the Helsinki Declaration of 1975 that was revised in 2000.

A total of 10 preclinical students were selected using the simple random sampling from a class of 30. They were made to do tooth preparations for metal-ceramic and complete metal crowns. Three preparations were done by each student. Hence the sample size is 30. The 3 Preparations were classified based on the usage of index as follows:

- Group A: 10 students (one preparation/student) without index.
- Group B: 10 students (one preparation/student) with cross sectional and sagittal section indices.
- Group C: 10 students (one preparation/student) with hinged index.

The students were made to fabricate provisional restoration after the tooth preparation using indices.

Group A students fabricated the provisional restorations using the unsectioned index which was fabricated prior to tooth preparation and was not used during tooth preparation.

Group B and Group C students fabricated provisional restorations using sectioned and sectioned hinged index respectively. After the preparation students were made to fill a questionnaire regarding the preparation which included the following questions:

a. Duration, Accuracy and Comfort during preparation

b. Duration and Accuracy of provisional restoration fabrication

Materials used to fabricate the sectioned hinged single piece index are as follows:

1. Maxillary and mandibular dentulous models (Frasaco).
2. Stainless steel wires (19 gauge).
3. Adam's pliers.
4. Addition silicone putty consistency.
5. Bard Parker blade with handle (no. 15 blade, no 3 handle)
6. Marker pens.

Technique of Fabrication of Hinged Index

First the mandibular first molar was removed from the completely dentulous model to create a partial edentulous situation where fixed partial denture could be fabricated with right mandibular second premolar and second molar as abutments. The root socket area was filled with wax. Then a straight 19 gauge wire of sufficient length extending at least one tooth adjacent to the teeth in question was taken. In the study, it was the canine mesially and 2nd molar distally. With the help of Adam's pliers loops were made on the ends of the wire so that it acts as a retentive terminal and then it was placed on the model [Table/Fig-1a].

Small amount of addition silicone (base and catalyst) was mixed to secure the wire on to the model in such a manner that the wire is kept atleast 1 mm from contacting the model. After securing the wire, silicone putty was mixed in adequate quantity and adapted onto the teeth in question and at least a tooth adjacent to it, to make an index, from buccal and lingual aspects and it was then extended to the occlusal surface. This was done so that stainless steel wire does not get displaced. After the silicone putty set, it was removed from the study model and the excess was trimmed [Table/Fig-1b].

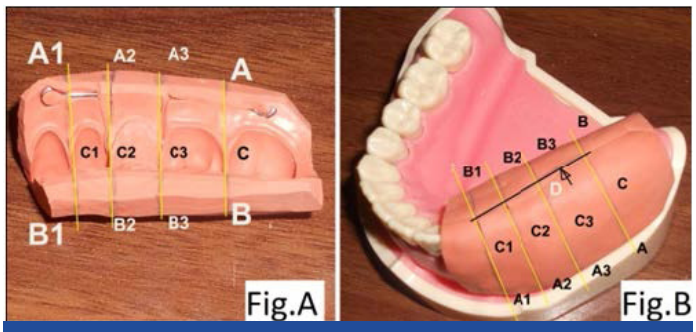
Point A and B were marked in buccal and lingual aspect respectively at interproximal region between 1st and 2nd molar with marker pens, for sectioning. Then the points A and B were joined with incision line C on the internal surface of the putty matrix.

In the same way, the points A1 and B1 were placed on the buccal and lingual aspect respectively at theinter proximal region between 1st premolar and canine which was joined by incision line C1 on the internal surface of the putty matrix.

After this, incision marks were placed, C2 and C3 distal to the 1st premolar and medial aspect of 1st molar respectively. The incision was extended to points A2, A3 as well as points B2, B3 on the buccal and lingual aspects of the matrix [Table/Fig-2a].

Now the central groove of the 1st molar and 1st premolar on the internal surface of the matrix was determined and an incision D was placed, which extended all the way from distal aspect of 1st molar to mesial aspect of 1st premolar [Table/Fig-2b].

[Table/Fig-1a]: Stainless wires are in place **[Table/Fig-1b]:** Fabricated silicone putty index



[Table/Fig-2a]: Tissue surface of index showing pen marks for sectioning **[Table/Fig-2b]:** Top surface of index showing pen marks for sectioning,arrow indicated section line D

[Table/Fig-3]: Occlusal view of index with buccal and lingual halves hinged **[Table/Fig-4a]:** Buccal view with buccal half of index hinged and lingual half closed **[Table/Fig-4b]:** Lingual view with lingual half of index hinged and buccal half closed

[Table/Fig-5a]: Bucco-proximal view **[Table/Fig-5b]:** Linguo-proximal view

[Table/Fig-6]: Occluso-proximal view **[Table/Fig-7]:** In vitro frontal view of anterior hinged index

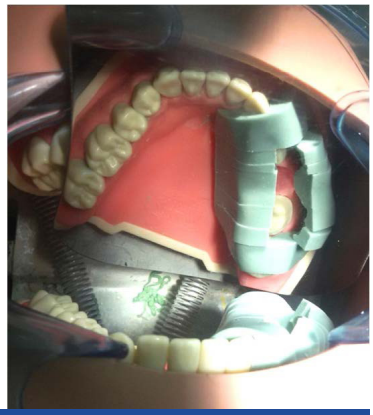
Finally, we had single piece putty index which was hinged around wire, embedded in it. This hinged putty matrix helped in visualising the teeth in following aspects:

a. Occlusal view with both buccal and lingual halves hinged [Table/Fig-3].
b. Buccal half view with lingual half closed and buccal half hinged [Table/Fig-4a].
c. Lingual half view with buccal half closed and lingual half hinged [Table/Fig-4b].
d. Bucco-proximal view [Table/Fig-5a].
e. Lingual –proximal view [Table/Fig-5b].
f. Occluso-proximal view [Table/Fig-6].

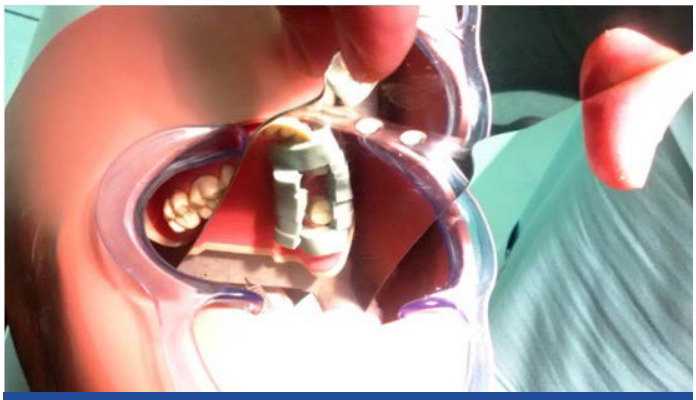
Practically all the possible aspects of the tooth can be visualised by a single index which would help us to determine the accurate preparation of the desired tooth. The hinged indices were fabricated for anterior and posterior tooth preparation and were used in the phantom head in the present study .In vitro view of anterior hinged index is illustrated in [Table/Fig-7] and invitro view of posterior hinged index is illustrated in [Table/Fig-8-10] as frontal view, occlusal view with buccal half retracted and occlusal view with lingual half retracted respectively.

RESULTS

The results are shown in the [Table/Fig-11]. The results were statistically analysed using SPSS software version 16.



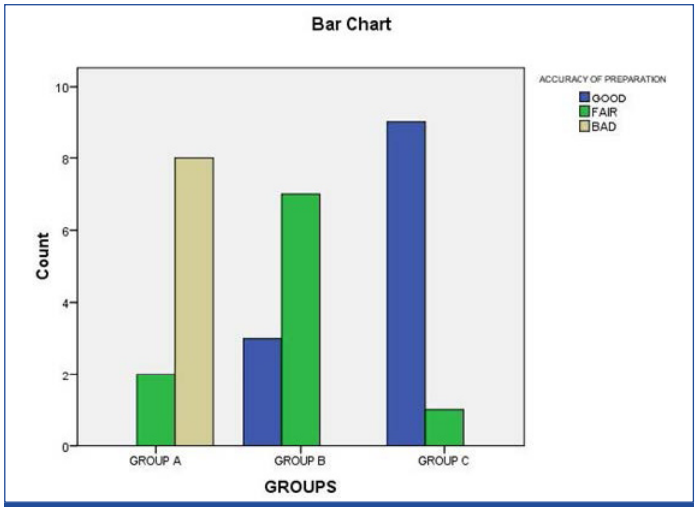
[Table/Fig-8]: In vitro frontal view of posterior hinged index
[Table/Fig-9]: In vitro occlusal view of posterior hinged index with buccal half retracted



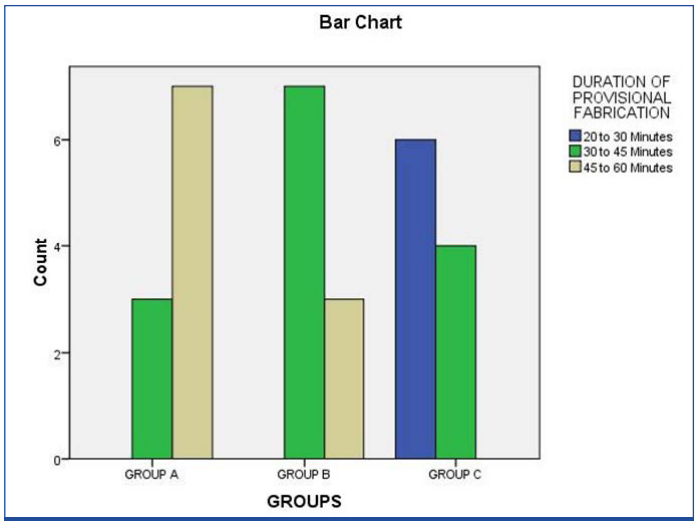
[Table/Fig-10]: In vitro occlusal view of posterior hinged index with lingual half retracted

Questions/ Groups	Group A in %	Group B in %	Group C in %
Duration of Preparation			
a) 20 to 30 Minutes	0	60	0
b) 30 to 45 Minutes	50	40	70
c) 45 to 60 Minutes	50	0	30
Accuracy of Preparation			
a) GOOD	0	30	90
b) FAIR	20	70	10
c) BAD	80	0	0
Ease in Preparation			
a) GOOD	80	20	0
b) FAIR	20	80	40
c) BAD	0	0	60
Duration of Provisional Fabrication			
a) 20 to 30 Minutes	0	0	60
b) 30 to 45 Minutes	30	70	40
c) 45 to 60 Minutes	70	30	00
Accuracy of Provisional			
a) GOOD	80	60	0
b) FAIR	20	40	50
c) BAD	0	0	50

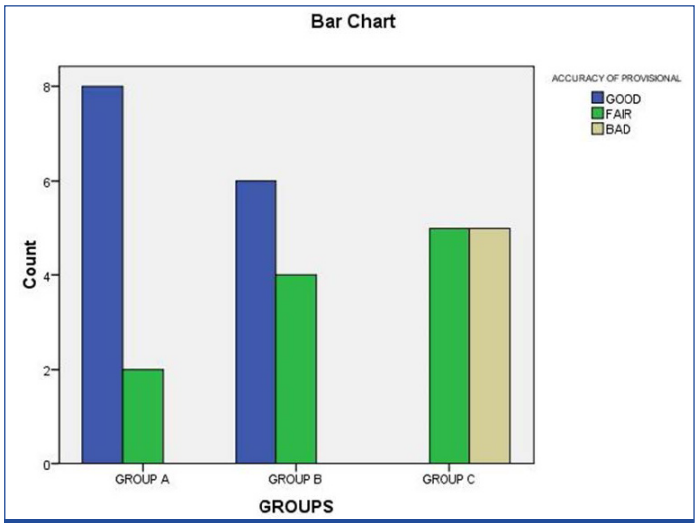
[Table/Fig-11]: Results of the questionnaire across the different groups



[Table/Fig-12]: Graph illustrating accuracy of preparation across the groups



[Table/Fig-13]: Graph illustrating duration of provisional fabrication across the groups



[Table/Fig-14]: Graph illustrating accuracy of provisional fabrication across the group

DISCUSSION

From the present study it was found that 60% of Group B preparations were finished in 20 to 30 min. It was also found that 70% of Group C preparations and 50% of Group A preparations were finished in 30 to 45 min.

Regarding the accuracy of the preparation, 90% of Group C preparations were found to be very accurate whereas only 30% of Group B preparations were found out to be very accurate. However, 80% of Group A preparations were found out to be very inaccurate.

The questionnaire also revealed that 80% of Group A preparations were found to be very easy to work without index. On the contrary only 20% of Group B preparations were found to be easy to work with sectional index. With regard to Group C preparations only 40% students found it fairly easy to work with the hinged index.

The time taken for fabrication of provisional restoration using sectioned hinged index by 60% of Group C preparations was 20 to 30 min, whereas 70% of Group A and B preparations took longer

to fabricate the provisional restoration which was 45 to 60 minutes and 30 to 45 minutes respectively.

When asked about the accuracy of the provisional restoration, 80 % of Group A preparations done by students said that the provisional restoration fabricated from unsectioned index was very accurate whereas only 60 % of Group B preparations done by students who used sectioned index found it very accurate. On the contrary only 50 % of Group C preparations done by students found that the provisional restoration which was fabricated with the help of sectioned hinged index was fairly accurate.

It has been proven beyond doubt that by using index accurate tooth reduction is feasible [1-4]. The present study also confirms that the usage of index is vital for tooth preparation as seen from [Table/Fig-11,12]. Literature does not exist for the usage of 2 or more indices simultaneously. Hence, the chance of errors while evaluating the tooth preparation increases when using multiple indices. The hinged type of silicone index reduces this error and by using this index chair time is much reduced and accurate tooth preparation is feasible. The hinged index could also be used for fabrication of temporary restorations as this particular type of index could be put back in place because of the hinge action whereas we need to fabricate a separate index for fabrication of temporaries when we use other types of indices. The time needed to fabricate the provisional restoration is significantly reduced as seen in [Table/Fig-13]. On the contrary the accuracy of the provisional restoration fabricated by using an hinged index is not as good as unsectioned index as seen in [Table/Fig-14].

CONCLUSION

The hinged sectioned index is an effective alternative to unsectioned as well as sectioned index. The accuracy of the tooth preparation done with the help of hinged sectioned index is better than sectioned index. The time taken to fabricate the provisional restoration is markedly reduced by means of hinged sectioned index but the accuracy of the provisional restoration fabrication is less when compared to other indices used in the study. Hence, as a mark of conclusion this hinged sectioned index is a viable option when accuracy of tooth preparation and speedy fabrication of provisional restoration. Further invivo studies have to be conducted to check its reliability and accuracy when used intra-orally.

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REFERENCES

[1] Shillingburg HT, Hobo S, Whitsett LD, Jacobi R, Brackett SE. Fundamentals of Fixed Prosthodontics. Third edition, Carol Stream, IL: Quintessence Publishing Co., Inc.; 1997.
[2] Rosenstiel SF, Land MF, Fujimoto J, Contemporary Fixed Prosthodontics, 4th Edition, St. Louis: Mosby Elsevier, 2006.
[3] Oh WS, Saglik B, May KB. .Tooth reduction guide using silicone registration material along with vacuum-formed thermoplastic matrix. *J Prosthodont*. 2010;19(1):81-83.
[4] Aminian A, Brunton PA.A comparison of the depths produced using three different tooth preparation techniques. *J Prosthet Dent.* 2003;89(1):19-22.
[5] Goodacre CJ, Campagni WV, Aquilino SA. Tooth preparations for complete crowns: An art form based on scientific principles. *J Prosthet Dent.* 2001;85:363-76.
[6] Limpinsel W. Measurement of occlusal reduction for cast restorations. *J Prosthet Dent.* 1985;53:838-39.

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