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Clinical Evaluation of Porcelain Fused to Metal Inlay-Retained Bridges

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Abstract:
Introduction: *Inlay retained bridges represent a conservative approach to restore single missing posterior tooth.* ***Objective:*** *To evaluate the clinical performance and survival rate of inlay retained fixed partial dentures.* ***Materials and methods:*** *A total of 12 patients were included in this clinical study. The patient selection, preparation technique as well as restoration fabrication followed current principles in this science. Patients were evaluated after the final cementation at 3, 6, 12, 24 and 36 months as follow-up period. The evaluation criteria were includes, post-operative sensitivity, de-bonding of the retainer, secondary caries, fracture of the retainer and fracture resistance.* ***Results:*** *A high rate success was observed during the different evaluation periods. Post-operative sensitivity during 3 months and de-bonding of the retainers during the 36 month follow-up was observed in single independent cases.* ***Conclusions:*** *Inlay retained bridges with adhesive cement appear to be an effective restoration in a single posterior missing tooth. Practitioners should consider its use as an alternative to other restorative options.*
Key Words*: Inlay-retained bridges, Adhesive cement, Survival rate*

I. Introduction

Different treatment-planning modalities can be made for restorations in patients who have lost maxillary or mandibular posterior teeth, unilaterally or bilaterally.[1] Implant prosthodontics has become the choice of replacement of the natural teeth. The conventional method of construction of the removable partial denture continues to be an essential prosthetic consideration in different oral reconstructions, especially when implant therapy may not be used to replace missing natural teeth for certain patients.[1-2]

For many years, the only prosthetic application used to deal with cases for single missing tooth was a fixed partial denture (FPD) however, the preparation of the two teeth required a correction for a single tooth deficiency causes unnecessary tissue loss.[3] Although full coverage metal–ceramic FDPs are still viewed as the standard for tooth replacement, they have disadvantages, such as decreased likelihood of retention, associated soft-tissue pigmentation and an opaque-to-darkish appearance in the cervical area of the abutment teeth.[4]

The other treatment optiones, one missing tooth can be restored using inlay-retained fixed partial dentures (IFPDs), in combination with an adhesive luting technique.[5-6] They are good alternative to conventional types, because they are less expensive, greater preservation of tooth structure and easier for periodontal assessment.[4]

Inlay retained FPDs are indicated in the presence of amalgam restoration or caries in abutment teeth adjacent to edentulous space with opposing artificial teeth[7-8] and slight drifting of abutment teeth with absence of heavy forces from opposing arch.[9]

Although these constructions were originally made of metal ceramic restorations, IFPDs are currently selected due to their various advantages when compared to full veneered PFM restorations and tooth-coloured restoration, because of an adhesive and the tissue-saving properties of these restorations.[10] Information on the longevity of IFPDs should be considered in the selection of materials, operative techniques and patient instructions related to prognosis and long-term cost-effectiveness.[11]

The aim of this study was to evaluate the clinical performance and survival rate of inlay retained fixed partial dentures (included postoperative sensitivity, de-bonding, secondary caries, fracture of the retainer and fracture resistance), constructed for replacement of a single tooth in the posterior region and cemented with adhesive resin cement. The follow-up period was up to 36 months.

II. Material and methods

A total of 12 male patients with a missing maxillary/or mandibular second premolar or first molar were selected for this study. The entire patients were referred from examination and diagnosis unit to prosthodontics Department College of dentistry. The ages of the patients were between 19 to 40 years.

The criteria for patient selection were includes: both abutments are vital with zero grade mobility, presence of occlusal carious or filling on the abutments , occluso-gingival axial dimension at least 3 mm, edentulous area up to 12 mm maximum mesio-distally, occlusal stability, no signs of para-functional habits

(figure-1). Patients with any medical condition that impaired correct hygiene were excluded. The radiographic examination for the abutments teeth were evaluated before the treatment (figure-2). All the clinical steps as well as laboratory procedures were carried by on operator. Inlays preparations were done according to the guidelines mentioned in the literature:[9][12][13] which includes, occlusal cavity depth with 2 mm, isthmus width 1.5-2 mm for premolars and 2.5-3 mm for molars, 1.5 mm proximal box, taper of the axial walls (except some carious abutment, all the carious was removed then modification of the preparation for inlay) (figure- 3). Standard inlay burs were used for the preparation of all abutments (KometBrasseler, Germany).

Inlay- retained bridges were fabricated according to the manufacturer's instructions. Impressions were taken with additional silicon (Virtual, IvoclarVivadent, Schaan, Lichtenstein) using a two-step putty-wash impression technique and poured with type IV dental stone. The cavities prepared at the abutments were filled with a provisional methacrylate material (PLASTER, GHIMAS, BOLOGNA, ITALY). The wax-up, investing and metal casting were done with nickel chrome metal alloy (Wiron - 99, Bego, Geramany). Metal try –in (figure- 4). The shade guide selections were done using shade guide system (3DMaster, Vita Zahnfabrik, Bad Sackingen, Germany). The porcelain build up was done with feldspathic porcelain ceramic build–up (VMK 95, Vita, Germany) (figure-5), porcelain try-in was done for every case, occlusal adjustment during different mandibular movements, then glazing of the restoration (figure-6). All the cases were cemented with adhesive resin cement (Variolink II, IvoclarVivadent, Schaan, Liechtenstein) after sandblasting of the inlay fitting surfaces (figure-7). The enamel were treated with 37% phosphoric acid (Total Etch), after that, Syntac Primer and Adhesive were applied (15 and 10 seconds, respectively). A thin layer of the bonding agent (Heliobond) was then applied and light cured for 20 seconds. The cement was applied to the inner surface of the IFPDs as well as the prepared teeth surfaces. A glycerin gel was applied to the all border of the fitting surfaces in order to prevent oxygen inhibition. Occlusal adjustments were carried out before cementation. However, we re-checked occlusal contacts after cementation, as de-bonding may be related to improper occlusaladjustmen. Proximal margins were finished with Sof-Lex XT discs (3M ESPE, Germany).

The clinical evaluations were performed after 3, 6, 12, 24 and 36 months after final cementation according to the criteria suggested by Hannigan and Lynach[14]

1. Successful: no need for any kind of intervention
2. In function: the patient could not examine directly, but confirmed no need for re-treatment.
3. Unknown: contact with the patient could not be established.
4. Repaired: the restoration was in function, but there was a need for major correction.
5. Failed: restoration lost retention with fracture of the frame or abutments.

All the data collected were analysis for categories successful, repaired or failed according to the modified USPHA classification.[15] The evaluation criteria includes; postoperative sensitivity, de-bonding, secondary caries, fracture of the retainer and fracture resistance. The scoring system was; Excellent (a), Acceptable (b), Reparable (c) and irreparable (d). The same investigator that placed the IFPDs carried out the baseline and the follow-up evaluations. The data was entered into the computer (MS-Office, Excel). The collected data were subjected to statistical analysis using SPSS software package ver. 12.0 (SPSS, Chicage, IL, USA).

III. Results

Overall the patients were satisfied with the IFPDs. The clinical evaluation result on each of the follow up was found to be excellent. According to Walton's criteria of clinical evaluation all patients fulfilled the criteria for "SUCCESSFUL" at 6th, 12th and 24th month and 8.4% patients "IN-FUNCTION" at 3rd and 36th month follow up (Table-1).

The results according to the Modified USPHS criteria suggest that the majority had absolutely no problem with the mentioned clinical evaluation parameters except for two patients. One patient had slight post-operative sensitivity on the first follow up which then subsided on subsequent visits. At the 36th month follow-up, de-bonding of retainer on first premolar had occurred in a 40 year old patient. However the IFPD was function (Table-2).

Table (1) Survival rate according to Hannigan and Lynach [14]

	3 months n= 12	6 months n= 12	12 months n= 12	24 months n= 12	36 months n= 12
Successful	**11**	**12**	**12**	**12**	**11**
In-function	**1**	**0**	**0**	**0**	**1**
Unknown	**0**	**0**	**0**	**0**	**0**
Repaired	**0**	**0**	**0**	**0**	**0**
Failed	**0**	**0**	**0**	**0**	**0**

Table (2): Results according to the modified USPHS criteria [15]

	Basic examination	3 months	6 months	12 months	24 months	36 months
Post-operative sensitivity	12	10 a 1 b	12 a	12 a	12 a	12 a
De-bonding of the retainer	12	12 a	12 a	12 a	12 a	11-a 1-c
Secondary carious	12	12 a	12 a	12 a	12 a	12 a
Fracture of the retainer	12	12 a	12 a	12 a	12 a	11-a
Fracture resistance	12	12 a	12 a	12 a	12 a	11-a

IV. Discussion

Inlay retained fixed partial dentures are good alternative to conventional FPD, as they are less expensive, greater preservation of tooth structure and easier for periodontal assessment. It offers a more conservative method of tooth replacement compared to crown retained bridge because tooth preparations are limited to the occluso and mesio/ distal surface of the abutments.[16]

In the last few years a lot of studies evaluated the inlay retained bridges, which constructed from fiber reinforced composite, new ceramic materials or free metal IFPDs. All the studies concluding that, a fracture occurs at the joint area between the pontic and abutment area during follow-up period. [13][16-18]. So attention was given to this point during the designing of our study. Because, clinically the fracture resistance of inlay retained FPD is related to the size, shape and position of the connector and the span of the pontic.[16] In addition to that composite used for veneering of the restoration exhibit, polymerization shrinkage, poor wear resistance, discoloration, fractures of the facing, fiber exposures of the veneering composite. [19-20]

In this study IFPDs were evaluated with cast metal framework support to avoid the fracture that occurs at the joint area between abutment and pontic, reduce the cost to the patient and the availability of these restorations at the dental laboratories.

Our finding coincide with the finding of SARIDAĞ & ÖZYEŞİL, 2008 and Sadeghi, 2008 ,[16-17] whose concluded metal IFPDs shows resistance to fractures more than to other materials used for fabrication of these types of bridges.

This study evaluated the replacement of a molar and premolar with a conservative IFPDs, the results shows a high score success rate for short term follow-up, this is in agreement with Watzke et al, 2010 (18) and with the finding of Cenci et al, 2010.[11]

Regarding post-operative sensitivity which was reported during the 3ed month evaluation of IFPDs, this could be explained by the using of glycerin gel which inhibit the oxidation of cement, the polishing of the margins and the following of the instructions that recommended by the manufacture's during and after the final cementation of IFPDs.[21]

From table 2 it shows a de-bonding of the retainers in a case of the mandibular premolar area at 3 years follow-up, this is in agreement with Song et al, 2003,[22] who concluded that deboning in the premolar area appeared to be more, due to the smaller bonding area and narrow connectors dimensions. De-bonding is reported to be more in mandibular restorations rather than of axillary,[13] this could be related to different mandibular movements during mastication, and the size of the bonding surfaces in the premolar area. A second factors could be due to the different in the co-efficient of thermal expansion of the restorative materials as well as cements and tooth structures.[23-24] Also could be explained by the starting of bond disintegration at this area.[23]

The occlusal adjustments in this study were checked and carried out before the final cementation process. However, occlusal contacts were rechecked again after cementation, as de-bonding may be related to improper occlusal adjustment, this is in agreement with Vallitu&Sevelius, 2000.[25]

Secondary caries was not detected during the 36 months (evaluating periods), this is in agreement with Cenci et al, 2010 and Jevremovic et al, 2010,[11][13] whose follow-up cases for 2 years and 8 years respectively.

Patient selection for inlay retained FPD restoration is an essential requirement for clinical success.[16] Also abutment high, framework design, and adhesive cements are factors play a vital role in the survival rate and success of these restoration.

Patients showed satisfied with this type of restoration, even those shows slight sensitivity or de-bonding. They were interesting in retreatment rather than the conventional full crown retainers.

V. Conclusions:

Within the limits of this short clinical study. Inlay retained bridges with adhesive cement are techniques sensitive, conservative and appear to be an effective permanent restoration for posterior missing tooth. Practitioners should consider IFPDs as an alternative to the conventional restorative options. Long –term clinical evaluation still need to be carried out to reveal the longevity and the oral performance of these types of restorations.

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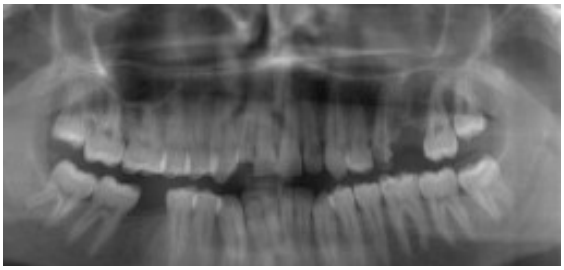

Figure-1: Occlusal view with abutments fillings
Figure-2: Panoramic view shows edentulous space



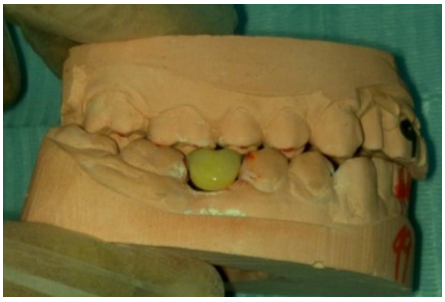

Figure-3: Inlay preparation on abutments
Figure-4: Framework try-in


Figure-5: Intra oral occlusal adjustment during porcelain try-in
Figure-7: After cementation and during lateral movement.