Effect of Two Temporary Restorative Materials Acropars and Trim on Periodontium: A Comparative Study

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Abstract

Background and aim: Temporary restoration is one of the important phases of treatment in patients requiring fixed dental prosthesis. The materials used to construct these restorations should have satisfactory physical properties. The purpose of this study was to investigate the effect of temporary restorative materials Acropars in comparison with Trim on periodontium. Materials and methods: In this study, the effect of temporary restoration was measured on periodontium using the Loe & Silness Gingival Index (GI) with the Williams periodontal probe in the first week and the first month. Periodontist, who was blind to study, examined the GI. All of the obtained measurements were recorded. In this study, 40 tooth surfaces were measured for each group to determine the effect of Acropars and Trim on periodontium. Before crown preparation, the patients were examined and asked to record the medical history in order to ensure that no systemic problems were present, so that the patients were not involved with any periodontal disease and even had no history in this regard. The effects of a material were compared between the first week and the first month by Wilcoxon test, and the difference between the two materials was compared with the Mann Whitney test. Results: In this study, GI showed a statistically significant difference in the first week and the first month between Acropars and Trim. The GI showed a significant difference in the axial surface of Acropars between the first week and the first month, but this difference was not significant at proximal surface. The GI in both Acropars and Trim had no significant difference in the axial surface in the first week, but revealed statistically significant difference in the proximal surfaces in the first week and the first month. Conclusion: The results showed that the Trim clinically has better properties than Acropars. Features such as non-smooth surface and inappropriate marginal fit of Acropars showed their own clinical manifestations as gingivitis, mostly in the interdental areas. However, the Acropars can be used as it is available and cheaper but should take care of oral hygiene, controlling the plaque of patients and having more precision by a dentist in constructing a good interim restoration, preferably an indirect method.

Keywords: Temporary Restoration, Acropars, Trim, Periodontium

Introduction

Temporary restorations are commonly used in dentistry during prosthetic treatment and as a substitute for definitive restorations until construction (Patras et al., 2012). Due to the high demand for good aesthetic outcomes, the interim restoration has become a valuable tool for detection of aesthetic and functional aspects of restoration. Dentists can win the trust of their patients with respect to this issue and achieve successful treatment and predictions essential for the success of the final restoration (Kadiyala et al., 2016). The fabrication of an ideal temporary restoration is very important for maintaining the health of the gingiva, protecting the pulp, restoring the lost tissue through the prosthesis to achieve acceptable appearance, minimizing the movement of abutments, and evaluating of the tooth and the definitive prosthetic function (Kadiyala et al., 2016; Burns and Beck, Nelson, 2003).

Temporary restorative materials are divided into two categories in terms of chemical compounds: monomethacrylate or acrylic resins, such as polymethyl methacrylate (PMMA) and poly (ethyl/butyl methacrylate) (PEMA/PBMA), and dimethyl acrylate or bis-acryl

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composite resins, such asbisphenol A-glycidyl methacrylate (BisGMA) and urethane dimethacrylate (UDMA). These resins are photopolymerized (Burns and Beck, Nelson, 2003).

The restoration should have a perfect marginal fit, proper dental contouring and smooth surfaces to prevent the accumulation of plaque. Particularly, it is important that marginal crown should not place apically than free gingiva. If the interim restoration is inappropriate and the plaque is uncontrolled, the gingiva health will be compromised. Maintaining the health of the gingival tissue is always considered one of the factors in the choice of interim restorative materials (Rosenstiel, Land and Fujimoto, 2015). Inflamed and hemorrhagic gingival tissues make it difficult to continue the next steps, such as taking impression and cementing. The interim restoration, which needs to be used for a long time, should have perfect marginal fit. The placement of the edge of restoration on gingival tissue causes an ischemic event, which is initially characterized as whitening of the tissue color. If this condition is uncorrected, a localized inflammation or necrosis may occur (Rosenstiel, Land and Fujimoto, 2015).

Also, the interim restoration should protect the tooth weakened due to the preparation of the crown. This is especially important in partial preparation with finishing line close to occlusal surface and may be damaged when chewing (Rosenstiel, Land and Fujimoto, 2015).

Dentists often do not construct the interim restoration before placing the final restoration that lead to increasing the aesthetic risk and the soft tissue on the abutment usually collapses. In such case, the soft tissue formation with an interim restoration can help to reestablish the natural gingival contours and interdental papilla (Rubinoff, 2003).

One of the methods of tissue control is to place a temporary restoration immediately after extraction of the tooth. This temporary restoration can be fixed or removable (Burns, Beck and Nelson, 2003). For this purpose, David R. used an acrylic denture tooth as pontic (David, 2004). The interim restorations are used as a diagnostic tool for verifying the aesthetic, the contours and the availability of health care, and transcription led to the construction of the final restoration (Mijiritsky, 2006).

The shrinkage caused by polymerization of resins plays an important role in the fit of temporary restorations. The shrinkage occurs in the resins due to the setting. The shrinkage of pure methyl methacrylate is about 21%, but the shrinkage caused by polymerization of acrylic resins used in dentistry is lower because part of the materials of these resins has already been polymerized (Ronald, Jack and John, 2018). According to a study of Stanley, when an external heat is applied to an intact tooth, there is an increase of temperature in the pulp by 5.6°C which result in a loss of life of 15% of the pulp tissue and an increase in temperature to 30 degrees Fahrenheit (16.8°C) will cause an irreversible (100%) necrosis of the pulp tissue (Stanley, 1971). Several studies have been done on comparing the effects of different types of restoration. Peralta et al. conducted a study entitled the evaluation of physical-mechanical properties, antibacterial effect, and cytotoxicity of temporary restorative materials (Peralta et al., 2018). Temporary restoration also can be used during orthodontics treatment. In a study of "effects of surface treatment and artificial aging on the shear bond strength of orthodontic brackets bonded to four different provisional restorations" by Al Jabbari et al. The results showed that the type of provisional material, surface treatment and age of prosthesis had a significant effect on bond strength. Sandblasting has a positive effect on the shear bond strength (Al Jabbari et al., 2014).

Careful selection of material type and construction techniques of interim restoration is very important. Various materials are used to construct the interim restoration. The nature of each material can have an effect directly on the fitness and the surface treatment of interim restoration. On the other hand, Acropars as an interim restorative material, has entered the dental market today, which has better access to purchase and lower cost. The purpose of this study was to investigate the effect of Acropars in comparison with Trim on periodontium.

Materials and Methods

In this study, 40 tooth surfaces were needed for each group to determine the effect of Acropars and Trim on periodontium taking 80% test power and 90% confidence interval using the equation below:

$$n = \frac{(z\beta + z\alpha)^2 (sD_1^2 + SD_2^2)}{(\mu_2 - \mu_2)^2}$$

The study was performed on 37 tooth surfaces. Before crown preparation, the patients were examined and asked to record the medical history in order to ensure that no systemic problems were present, so that the patients were not involved with any periodontal disease and even had no history in this regard. The patients were educated about Oral Hygiene Instructions (OHI) including the proper use of dental floss and Bass brushing. Each patient should have at least two abutment teeth for material comparison, one for Trim and other for Acropars.

Thus, Interventional factors such as systemic problems, periodontal diseases, and hygiene control were attempted to remove or minimize them. Complete crown preparation for PFM restoration was standardized on the desired teeth. Shoulder / bevel finish lines were considered at all surfaces. The shoulder margin with a bevel of 45-degree and 0.5-mm width was placed subgingivally crown preparation extent was 1.2 mm in axial and proximal walls (Rosenstiel, Land and Fujimoto, 2015). The width of the finish line of crown preparation was the same in all samples, and the same person performed all the crown preparation processes and constructed the interim restoration. The putty index of the modified diagnostic cast was used initially to fabricate the interim restoration. After ensuring that the index was completely positioned on the teeth in the mouth, petroleum applied to the surface of the adjacent and abutment. Then, a sufficient amount of restorative material powder and liquid (12 drops) was mixed and placed in the index, in accordance with the manufacturer's instructions. (Rosenstiel, Land and Fujimoto, 2015) Then, the index was placed on prepared teeth and was taken before hardening to remove the additional interim restoration from the undercuts of adjacent teeth. The additional substance was removed with scalpel and the index was re-placed on the teeth until harden the material.

After setting of the interim restoration, the additions were removed by carborundum disk. Then, a paper disk was used to polish the axial surfaces of the restoration margins. After correcting the occlusion and shape in the mouth with 400-grit sandpaper, the restoration surface was polished with pumice powder and polishing machine. It should be noted that the polishing method was performed for both materials with similar manner. After that, the interim restoration was cemented by Zinc Oxide Eugenol Cement (Temp-Bond). In order to remove additional cement easily, petroleum applied to the outer polished surfaces of restorations. The two pastes were mixed according to the manufacturer's instructions, and a small amount of cement was placed inside the restoration and mounted seated on the tooth with a finger pressure. Filling the restoration with cement was refused because it takes time to clean and raise the risk of remaining debris in sulcus. The amount of extra cement was carefully removed by an explorer and dental floss. The sulcus was completely controlled and then washed off with an air-water syringe. The patient was advised to refuse to eat for up to an hour in order to harden the cement, and avoid from eating rigid and sticky food until the preparation of definitive restoration.

In this study, the effect of temporary restoration was measured on periodontium using the Loe & Silness Gingival Index (GI) with the Williams periodontal probe in the first week and the first month. A gingiva specialist, who was blind to study, examined the GI. All of the obtained measurements were recorded. The effects of a material were compared between the first week and the first month by Wilcoxon test, and the difference between the two materials was compared with the Mann Whitney test.

Results

The GI showed a statistically significant difference in the first week and the first month between Acropars and Trim (Table 1).

surface related to the material in first week Score	Acropars	trim	total surfaces	Mann-Whitney
1	5	18	23	test(U=630, P=0/004)
2	35	26	61	
total	40	44	84	
surface related to the material in first month Score	Acropars	trim	total surfaces	Mann-Whitney
1	15	33	48	test(U=550, P=0/001)
2	25	11	36	
total	40	44	84	

Table 1- Comparison of Gingival Index in the first week and first month between Acropars and Trim

Based on the GI, there was a significant difference in Acropars and Trim between the first week and the first month (Table 2).

Table 2- Comparison of Gingival Index in both Acropars and Trim between the first week and firstmonth

Time	first week				first m	onth	
Score material	1	2	total surfaces	1	2	total surfaces	
Acropars	5	35	40	15	25	40	Wilcoxon test (z=-3/638, P=0/001)
Trim	18	26	44	33	11	44	Wilcoxon test (z=-3/162, P=0/002)

The GI indicated a significant difference in the axial surface of Acropars between the first week and the first month, but this difference was not significant at proximal surface. The GI had a significant difference in the axial surface of Trim between the first week and the

first month. The GI had a significant difference in the proximal surface of Trim between the first week and the first month. The GI showed no significant difference in both Acropars and Trim in the axial surface during the first week. The GI showed no statistically significant difference in both Acropars and Trim in the axial surface in the first month. GI showed a significant difference in both Acropars and Trim in the axial surface in the first month. GI showed a significant difference in both Acropars and Trim in proximal surface in the first week. The GI showed a statistically significant difference in both Acropars and Trim in proximal surface in the first week. The GI showed a statistically significant difference in both Acropars and Trim in proximal surface in the first week. The GI showed a statistically significant difference in both Acropars and Trim in proximal surface in the first week. The GI showed a statistically significant difference in both Acropars and Trim in proximal surface in the first week. The GI showed a statistically significant difference in both Acropars and Trim in proximal surface in the first week. The GI showed a statistically significant difference in both Acropars and Trim in proximal surface in the first month (Table 3). The measured GI had no scores 0 and 3 in any of the cases.

	material Score	Acropars	trim	
axial surface in the first week	1	3	9	Mann Whitney test (U-162
	2	17	13	P=0/067
	total	20	22	1 = 0/007)
axial surface the first month	1	9	10	Mann Whitney test (U-170
	2	11	12	P = 0/134
	total	20	22	1 =0/134)
proximal surface in the first week	1	2	9	Monn Whitney test (U-152
	2	18	13	P=0/025
	total	20	22	1=0/025)
proximal surface in the first month	1	5	17	Monn Whitney test (U-105
	2	15	5	P=0/001
	total	20	22	1-0/001)

Table 3- Comparise	on of G	lingival	Index i	n both	Acropars	and	Trim	in the	axial	surface	in t	the f	first	week
and the first month.	in the	proxima	l surfac	e in the	e first wee	ek an	d the f	ïrst m	onth					

Discussion

A total of 37 dental surfaces were proposed for each material, taking into account 80% test power and 90% confidence interval. In this study, 40 surfaces were investigated for Acropars and 44 surfaces for Trim.

Given the fact that the three properties of marginal fit, contour and smooth surface of the restoration affect the proper biological response to interim restoration, we have been careful to give the appropriate contour to the restoration in the construction of interim restoration. The polish was also performed using the same equipment. As a result, smooth surface and marginal fit depend on the quality of material. The construction conditions of the restoration material in this study were that the width site of the finish line of crown preparation was the same in all samples, and the same person performed directly all the crown preparation processes and constructed the interim restoration.

The results showed that the GI was decreased in axial surface of Acropars, and in the axial and the proximal surfaces of Trim between the first week and the first month, and there was a significant statistical difference. However, the GI showed a significant difference in the proximal surface of Acropars, indicating a greater accumulation of plaque, due to the non-smoother surface of Acropars than the Trim, and the lack of appropriate access to the area, but the axial surface has sufficient accessibility for the more plaque removal and auto-cleaning. The GI has improved since the first week, indicating smoother surface created in the above-mentioned material as well as better marginal fit. Vahidi showed that the level of shrinkage caused by the hardening of PMMA is high, which results in poor marginal fit in the direct method (Vahidi, 1987). The poor marginal fit causes plaque accumulation and gingivitis, which leads to an increase in GI, consistent with the present study in this regard. Also, there was no significant difference between GIs in Acropars and Trim in axial surface during the first week and the first month, indicating that the repair process after the unwanted injury induced by preparation was identical, and also there have been better plaque removal because of the easy access. Therefore, the healing process and reduction of inflammation in the above-mentioned surfaces occurred in both materials. Ednan et al. compared marginal fit in the interim restoration in the in vitro conditions. They showed that both materials (polyethyl methacrylate and bis-acryl) had no desired marginal fit, but the temporary cement thickness compensated the observed gap (Adnan, Khan and Umer, 2013). Mehrpour et al., in a study entitled " Evaluation of the Flexural Strength of Interim Restorative Materials in Fixed Prosthodontics ", showed that bis-acrylic composite resins were significantly better than traditional methacrylate and light-cured resins; they suggested the application of bis-acrylic composite resins in patients requiring long-term use of interim restoration (Mehrpour et al., 2016). Nejatidanesh et al. investigated the marginal fit of interim restorations made of four resins, and showed that interim restorations constructed with Acropars had a significant marginal gap (Nejatidanesh, Lotfi and Savabi, 2006). This finding is in part consistent with the results of this study. The Acropars has lower clinical properties than trim.

Edward et al. found that the dual-cure interim material (Luxatemp Solar) showed significantly more discrepancy at the marginal fit than the auto-cure bis-acryl materials or acrylic control (Edward et al., 2008).

Conclusion

The results of our study showed a significant statistically difference between GIs in both temporary restorative materials of Acropars and Trim in the proximal surface during the first week and the first month, which indicates that the recovery course in the Trim was better than in the Acropars. The value of GI was higher in the proximal surface of Acropars, highlighting a greater accumulation of plaque in these areas due to the non-smooth surface formed in this material, but this difference was not present on the axial surface, which was easier to access.

The results also showed that Trim had a reduced GI in terms of effects on gingiva after one month compared to that after one week, indicating an improvement in unwanted gingiva injury during crown preparation and gingival tissue adaptation to the restorative materials. This reduction in GI is higher in the Trim, indicating greater tissue compatibility of the Trim. The Trim has clinically better properties than Iranian Acropars. Features such as non-smooth surface and inappropriate marginal fit show their own clinical manifestations as gingivitis, mostly in the interdental areas. However, Acropars can be used due to the low cost and availability by adhering to the care of oral hygiene, controlling the plaque of patients and having more precision by a dentist in constructing temporary crown.

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