# Effect of Impla Fix and Duralay Acrylic Resin Splinting Materials on Dimensional Changes of Direct Implant Impressions

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#### Abstract

Background and Aim: Making impression of several implants simultaneously for
fabrication of dental prosthesis is challenging for many clinicians. Splinting can be
performed for highly accurate impression making and better adaptation of prostheses.
This study aimed to assess the effect of Impla and Duralay acrylic resin splinting
materials on dimensional changes of direct implant impressions.
Materials and Methods: In this in vitro experimental study, a master model was
fabricated using epoxy resin. Three fixtures were vertically placed with 15mm distance
from each other. Impression copingswerescrewed and splinting was performed with
Impla Fix and Duralay acrylic resin separately. Fourteen impressions were made of the
splints and dimensional changes were determined by measuring distances in x, y and z
axes on casts using coordinate measuring machine (CMM). Data were analyzed using
t-test.
Results: The mean and standard deviation of change in Duralay and Impla groups were
28.07±8.68µ and 25±7.39µ, respectively. Changes in x (P=0.746), y (P=0.772) and z
(P=0.631) axes were slightly greater in use of Duralay acrylic resin but the differences
were not statistically significant.
<b>Conclusion</b> . Impla splinting material is superior to Duralay acrylic resin due to smaller

**Conclusion:** Impla splinting material is superior to Duralay acrylic resin due to smaller dimensional changes and easy use.

Key Words: Dental Implants, Dental Impression Techniqu, Dental Prosthesis

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#### Introduction

Making impression of several implants simultaneously for fabrication of dental prosthesis is challenging for many clinicians [1]. Dimensional stability of impressions made of splinted impression copings is important for optimal fit of prosthetic restorations. Branemark et al. [2] were the first to point to the significance of splinting of impression copings to obtain higher accuracy. Implant-prosthesis misfit can result in stress transfer to implant and bone and may lead to impairment of osseointegration and bone fracture [3]. One method to obtain a precise fit is to use

different splinting materials and assess their effect dimensional stability of direct implant on impressions for fabrication of prosthesis using computer aided design/computer aided manufacturing system [4]. Splinting is an accepted method but the splinting material with the highest accuracy and dimensional stability is a matter of debate [5]. There is a gap of information on different splinting materials [6]. This study aimed to assess the effect of Impla and Duralay acrylic resin splinting materials on dimensional stability of direct implant impressions.

Hsu et al, [7], Burawi et al, [8] and Assif et al. [9]

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performed similar studies. Herbts et al. [10] compared the dimensional accuracy of impressions made of narrow square-shaped copings with splinted and non-splinted techniques and found no significant difference. Vigolo et al. [11] assessed the accuracy of impressions made of square-shaped impression copings splinted with autopolymerizing acrylic resin using particle-abraded and adhesive coated methods compared to nonsplinted impression method. They reported higher accuracy for impressions made of impression copings splinted with self-cure acrylic resin and particle-abraded and adhesive-coated copings.

Herbts et al, [10], Chio et al, [12] and Naconecy et al. [13] assessed the accuracy of splinted and nonsplinted impression techniques. This study aimed to assess the effect of Impla and Duralay splinting materials on dimensional changes of direct implant impressions.

### **Materials and Methods**

In this in vitro, experimental study, a master model was fabricated using CW2215 epoxy resin (Los Angeles, CA, USA). Using Index GB65 (CNC Digital, Inc., Frankfurt, Germany), site of fixture was determined and they were placed vertically with 15 mm distance. Acrylic special tray was fabricated using open tray technique. Impression copings were splinted by Duralay self-cure acrylic resin (Reliance, IL, USA) (Figure 1) and Impla Fix (Schudtz, Rosbach, Germany) light cure splinting material. Splinting material was then separated and re-connected again and model was fabricated. An indexwas fabricated and splinting was performed according to the index. Splints were then assessed in all points using a gage. After polymerization, the complex of copings and splinting material were stored for 24 hours in order for polymerization shrinkage to terminate. Next, 14 impressions were made of the splinted model using polyvinyl siloxane (Monopren Transfer; Kettenbach, CA, USA) via open tray technique[3]. Impression copingswere attached to the impression and the impression was poured with Vel-Mix gypsum (Kerr, Orange, CA, USA). Two hours were allowed for setting time of gypsum according to the manufacturer's instructions (Figure 2). The casts were measured in x, y and z axes using CMM (SP25M, Renishaw, UK) in microns (Figure 3).



Figure 1. Splinting of copings by Duralay acrylic resin



Figure 2. Gypsum model



Figure 3. CMM for three dimensional measurements

The central implant served as reference. To assess the position of fixtures, a ball with 3.185 mm diameter was placed in fixtures for measurement by the CMM with 0.1 $\mu$  accuracy. The CMM has a sensitive probe. The distance between the center of ball and external horizontal line angle was measured three times and recorded as the spatial position of implant. The three values had to be the same; if not, the sample was excluded and replaced with a new one. Changes were calculated using ttest since data had normal distribution.

# Results

This study was conducted on 14 Duralay acrylic

and seven Impla Fix samples; measurements were made in x, y and z axes. In x axes, changes were  $28.07\pm8.68\mu$  in Duralay and  $25\pm7.39\mu$  in Impla Fix. The changes were slightly greater in Duralay group but the difference was not significant according to t-test (P=0.746).

In y axis, changes were  $29\pm7.33\mu$  in Duralay and  $25.33\pm7.77\mu$  in the Impla Fix group. The changes were slightly greater in Duralay group but this difference was not significant (P=0.772).

In z axis, changes were  $241.78\pm8.66\mu$  in the Duralay and  $219.57\pm7.42\mu$  in Impla Fix group. These changes were slightly greater in Duralay group but the difference was not significant (P=0.631).

#### Discussion

Our results showed that splinting of copings in open impression technique with Duralay acrylic resin and Impla Fix was not significantly different in terms of the accuracy of final cast in x, y and z axes. However, in total, the accuracy of Impla Fix was slightly higher than that of Duralay. Ongul et al, [14] in their study in 2012 assessed five experimental groups (n=5). Experimental models were divided into non-splint (EG1) and direct splinted (EG2-EG5) groups. In EG2 and SynOcta EG3 groups, the impression copings were splinted with an acrylic resin band while in EG4 and EG5 groups, the impression copings were splinted with a light cured composite resin band. In EG3 and EG5 groups, resin bands were sectioned while this was not done in other groups. They showed that impression copings splinted with acrylic resin were superior to non-splinted groups and those splinted with light cure composite; their results were different from ours.

Cerqueriaet al, [15] in 2012 compared two acrylic resins (GC patternresin, Duralay II) and square transfer coping splinting methodsand reported that Duralay II should not be used for one piece splinting due to generation of high micro-strain, and separation and reconnectionis recommended. In use of GC pattern resin, change in splinting technique does not significantly affect the microstrain. Their findings were in line with ours. Avila et al, [16] in 2012 fabricated a master cast with four straight implants and a passive framework. Two groups each with five casts were designed: Group 1: square impression copings without splinting and group 2: splinted square impression copings with metal drill and pattern resin. They concluded that group 2 yielded superior results compared to group 1, which was in agreement with our results. In 2013, Lopes-Júnior et al. [17] compared four commercial brands of chemically active acrylic resins by photoelastic analysis. A resin block with two parallel implants and two splinted square copings was fabricated. Both were splinted with chemically active acrylic resins namely Dencrilay, Duralay I, Duralay II and GC. No significant difference was noted among the four commercial brands of chemically active greater acrvlic resins. Dencrilav showed dimensional changes. Duralay I and GC were recommended for transfer of the position of several implants.

In our study, difference in accuracy of Impla and Duralay was probably due to the higher polymerization shrinkage of acrylic resin. Performance of the operator can also affect the accuracy of the two splinting materials. With regard to the measurement tool, several methods are available, which must have an accuracy higher than that of impression making. Use of indirect techniques has been suggested for this purpose. In this method, a metal bar is fabricated on the model to assess the fit of framework and impression making indirectly. To assess the fit, Vigolo et al. [11] used profile projector, which was not suitable for this purpose. Naconeey et al. [13] used electronic sensor gages around the fixtures; this method was simple and had high sensitivity. Another method is the three-dimensional technique and CMM is among the most accurate threedimensional methods. Our study showed that distances were not accurately transferred to the final cast by use of the two materials. Several factors such as dimensional changes of gypsum, movement of coping during opening and closing of the guiding pin on the implant, changes in impression material and contraction of the splinting materials may affect the accuracy. Methodology of studies and design of experimental models, measuring devices and distances measured relative to different reference points as well as the difference in methods of splinting of metal copings are all variable in different studies and make accurate comparison of the results difficult. In vivo studies are required to increase the clinical generalizability of results and find the most accurate and simplest impression technique for dental implants. Future studies are required to find methods to increase the dimensional accuracy of final cast and better simulate the oral clinical setting to increase clinical generalization of results.

### Conclusion

The results of this study showed that splinting of copings in open impression technique by Duralay acrylic resin and Impla Fix did not affect the accuracy of final cast in terms of distances measured in x, y and z axes. However, in general, the accuracy of ImplaFix was slightly superior to that of Duralay.

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