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Tensile Bond Strength of Soft Liner to denture Base Resin Processed by two Commonly used Processing Techniques

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ABSTRACT

This study evaluated the effect of two commonly used methods of processing permanent soft liner on tensile bond strength between denture base and soft liner. Silicone based soft liner was used in this study. Ten heat cure dumbbell shaped specimens along with soft liner were processed together. Another ten heat cure dumbbell shaped specimens were fabricated and later relined with soft liner. All the specimens were subjected to tensile bond strength test. Specimens relined directly with soft liner at the time of processing the denture base resin showed significantly higher bond strength.

Keywords : Soft Liner, Heat Cure Denture Base Resin, Tensile Bond Strength

I. INTRODUCTION

Over the past century, poly methyl methacrylate denture base resin has been the material of choice for complete denture fabrication due to its low cost, adequate aesthetic properties and ease of manipulation. Patient using complete denture may experience discomfort due to thin and non-resilient oral mucosa and severe alveolar resorption. To alleviate these problems, resilient soft liners are used. Permanent soft liners are used to aid in distribution of functional loads to the denture bearing area, to avoid localized stress concentration, and to improve retention by engaging undercuts. Resilient liners are classified based on setting reaction as a chair side relining material and long term reliners. Long term reliners are mostly heat cured materials. Soft liners can be added to a new denture at the time of packing denture base resin. It can also be added to a already fabricated denture. There is not much research on the bond strength between soft liner and denture base resin processed by these two methods of relining the denture base resin. This study was done to determine the bond strength between denture base resin and soft liner processed by two common processing methods.

II. METHODS AND MATERIAL

Dumbbell shaped heat cure denture base resin specimens were fabricated to evaluate the bond strength. A standardized dumbbell shaped stainless steel die which is 5mmin diameter at the thinnest section and 20mm in diameter at the thickest section and 22mm in length was used to fabricate specimens. The metal die was duplicated in polyvinyl siloxane. Wax was melted and and poured into putty index and allowed to cool at room temperature. Fourty wax specimens were fabricated and divided into two groups.

Group 1: Specimens which were relined at the time of processing denture base resin

Group 2: Specimens relined after the denture base resin specimens were fabricated

Conventional compression mould technique was used to process all specimens in the study.

Group 1: Specimens which were relined at the time of processing denture base resin.

The base of the flask was filled with dental plaster and two dumbbell shaped wax specimens with metal spacer (Fig.1) in between was placed into first pour with only half of the specimen inside the plaster. Once the first pour was set, separating medium was applied and second pour of plaster was filled and flask was closed tightly using clamp. Dewaxing was done to remove wax. Separating medium was applied to the mould space prior to packing of acrylic resin. Heat cure denture base resin(DPI heat cure resin; Bombay ;India) was mixed according to the manufacturer instructions and packed into the mould with the 3mm metal spacer in the middle. Trail closure was done, excess resin and spacer were removed. Soft resilient liner (Molloplast B;Detax :Germany) was mixed and packed into the space created by the spacer. The flask was closed and processed in acryliser at 75 ^{0}c for one and half hours followed by 100 ^{0}c for 1 hour. Similar procedure was followed to obtain ten specimens of this group (Fig.2). The specimens were finished and stored in the distilled water until bond strength testing.

Figure 1: Dumbell shaped wax pattern

Group 2: Specimens relined after the denture base resin specimens were fabricated.

All the wax specimens were flasked by conventional method. Dewaxing was done. Heat cure denture base resin was mixed accordingly to manufacturer instructions and packed into mould space with metal spacer in the middle. The flask was closed under clamps and processed in acryliser at 75^{0}c for one and half hour followed by 100 ^{0}c for 1 hour. The obtain heat cured specimen was retrieved and finished and placed back into the mould. The metal spacer was removed. The soft liner was mixed according to the manufacturer recommendations and packed into the mould space obtained after removal of the spacer. The flask was closed and curing was done for 45 min at 100 ^{0}c. The specimens were retrieved and stored in distilled water at 37^{0}c.

Bond strength:

All the specimens were tested by universal testing machine (Minitech;Dax system Inc: India) for tensile bond strength. Each specimen was held in the universal testing machine and specimen was pulled apart at cross head speed of 5mm per minute(Fig.3). The load at which the specimen debonded was recorded. Tensile bond strength values obtained were tabled and statistically analysed.

Figure 2: Dumbell shaped heat cure acrylic resin specimens with soft liner

Figure 3: Testing of the specimens for tensile bond strength

III. RESULTS AND DISCUSSION

Results:

Table 1 : Comparison of tensile bond strength between two methods of soft liner processing. (Unpaired t test)

SNo	Group 1	Group 2
1	1.9721	0.3122
2	2.3128	0.2916
3	1.7821	0.2516
4	1.7585	0.2678
5	2.0937	0.3215
6	2.5121	0.2218
7	1.6821	0.2419
8	1.7218	0.2818
9	1.8016	0.2318
10	2.1226	0.2718
Mean	1.9730	0.2670
Standard deviation	0.2797	0.0333

The tensile bond strength values were subjected to unpaired t test. The mean tensile bond strength of specimens relined directly at the time of denture base resin was 1.97 MPa and mean tensile bond of specimens relined to already fabricated denture base specimens was 0.267 MPa (Table 1). Tensile bond strength of group 1 specimens was a significantly higher than the group 2 specimens.

Discussion:

Residual ridge resorption is a continuous process which is multifactorial but inevitable resulting in compromised retention of the prosthesis and trauma to underlying soft tissues. Application of resilient liner in the intaglio surface of the denture results in more even distribution of occlusal load and increases comfort to the patient. Soft liners reduce the traumatic effect that a denture may have on patients with atropic mucosa.

Resilient lining materials must have good adhesion to the acrylic resin denture base. Poor adhesion between the two materials can lead to functional and hygienic problems if they separate from each other during use.

Resilient soft liner can be applied directly to a new denture or a old denture can be relined with permanent soft liner. This present study evaluated the difference in bond strength between these two techniques. There is a significantly higher bond strength for soft liner applied directly to denture base material than the soft liner applied to already fabricated denture base resin.

The increase in bond strength between denture base and soft liner when applied directly at the time of processing of denture base could be due to better

control in resilient liner thickness and intimate adaptation between the denture base and soft liner.

IV. CONCLUSION

Within the limitations of the present study , the following conclusions are drawn. The mean tensile bond strength of soft liner relined directly to denture base resin during processing was 1.98 MPa. The mean tensile bond strength of soft liner relined to already processed denture base resin was 0.267 MPa. Bond strength of soft liner relined directly to the denture base resin during processing was significantly higher than the bond strength of the soft liner applied to already processed denture base resin.

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