The Effect of Plasma Treatment on the Bonding of Soft Denture Liners to Heat Cured Acrylic Resin Denture Base Material and on Some Surface Properties of Acrylic Resin Polymer

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Abstract

Statement of problem: Acrylic resin polymers used in dentistry are usually with problems in bonding, especially failure of the bond with soft denture lining materials.

Aims of the study: To investigate the effects of plasma treatment on improving the tensile bonding strength between acrylic denture base material and Vertex Soft, Molloplast-B soft denture lining materials, also on surface roughness, wettability, chemical surface changes, and physical surface changes for acrylic resin polymer.

Materials and methods: For tensile bonding strength and surface roughness tests, heat cured acrylic resin specimens with dimensions 8mm×10mm×30mm as width, height, and length respectively were prepared. For tensile test, each 2 specimens were joined by a 3-mm thick soft liner disk either Vertex Soft or Molloplast-B. The specimens stored in artificial saliva for two periods (48 hours, 12 weeks) before tensile testing. For wettability test, chemical and physical surface analyses, heat cured acrylic resin specimens with dimensions 8×2×30 mm as width, height, and length respectively were prepared. For each test done in this study, the specimens were grouped as plasma untreated, oxygen plasma treated and argon plasma treated acrylic specimens.

Results: Plasma treatment revealed an increase in tensile bond strength mean values for oxygen and argon plasma treated groups when compared with plasma untreated group for both Vertex-soft and Molloplast-B after the two periods of storage in artificial saliva with a statistically highly significant difference among the groups. The higher tensile mean values for Vertex-soft were recorded in oxygen plasma treated group, while for Molloplast-B, were recorded in argon plasma treated group. Results showed that, there was an increase in surface roughness values and a decrease in water contact angle values (i.e., increase in wettability) after the application of plasma treatment with a highly significant difference among the groups for acrylic polymer specimens. Chemical surface analysis for oxygen plasma treated group showed that, the treated surface undergone further chemical reactions, and that argon plasma treatment produced little chemical changes. Atomic force

microscopy images showed a collection of new distinct nanograins and numerous grooves (pit like structures) after oxygen and argon plasma treatments which increased the surface micro-roughness as compared with plasma untreated group.

Conclusions: Plasma treatment was an effective method for increasing adhesion strength, wettebility, surface roughness and produced chemical and physical surface changes by inducing further chemical reactions (mainly after oxygen plasma treatment) and physical topographical surface changes by means of physical sputtering (mainly after argon plasma treatment) for plasma treated acrylic resin specimens.