Abstract

**Statement of Problem**  Studies have shown that the physical characteristics of denture base materials may affect patient acceptance of denture prostheses by altering the sensory experience of food during mastication (e.g., chemical perception of taste, smell, textural perception, and temperature). Thermal diffusivity is one material property which has been cited as being important in determining gustatory response, with denture base acrylcs having low thermal diffusivity compared to denture base metal alloys.

**Purpose of Study**  The purpose of this study was to prepare and characterize experimental acrylic resin composite material with increased thermal diffusivity.

**Materials and Methods**  Sapphire (Al$_2$O$_3$) whiskers were added to conventional denture base acrylic during processing to achieve loadings of 9.35 and 15% by volume. Cylindrical test specimens containing an embedded thermocouple were used to determine thermal diffusivity over a physiologic temperature range (0-70°C).

**Results**  Thermal diffusivities of the sapphire-containing composites were found to be significantly higher than the unmodified acrylic resin. Thermal diffusivity was found to increase in proportion to the volume % of sapphire filler, suggesting that high aspect ratio ceramic particles formed a pathway for heat conduction through the insulating polymer matrix.

**Conclusion**  Thermal diffusivity of denture base acrylic resin is increased by the addition of thermally conducting sapphire whiskers.

**Clinical Significance**  This study may result in the development of a denture base resin with improved thermal diffusivity, which may lead to a more complete understanding of the contribution of thermal diffusivity to the general satisfaction of patients with full dentures.