Biocompatibility of two types of resins for prosthetic usage

Biocompatibilidade de dois tipos de resina para uso protético

Sigmar de Mello RODE
Associate Professor – Biopathology Post-graduation Program – School of Dentistry of São José dos Campos – UNESP – São Paulo State University – São José dos Campos – SP – Brazil

Bruno das Neves CAVALCANTI
Assistant Professor – Biodentistry Post-graduation Program – Ibirapuera University – UNIB – São Paulo – SP – Brazil

Vanessa FERRIELO
Student – Master of Science Degree – Biodentistry Post-graduation Program – Ibirapuera University – UNIB – São Paulo – SP – Brazil

Miriam Rubio FARIA
Assistant Professor – Biodentistry Post-graduation Program – Ibirapuera University – UNIB – São Paulo – SP – Brazil

Nelson VILLA
Associate Professor – School of Dentistry – Santo Amaro University – São Paulo – SP – Brazil

Abstract

The purpose of the present study was evaluate the biological compatibility of materials used to manufacture prosthetic appliances. A heat-polymerized colorless resin and one visible light-cured denture base material were tested by the implantation of probe discs, in the dorsal connective tissue of 12 Wistar rats. The animals were sacrificed at 7, 14, 21 and 28 days after implantation. The specimens were prepared for light microscopy observation. It was noted that either after light microscopy observations, both resins demonstrated a good level of biocompatibility within the connective tissue of the dorsum of the animals studied.

Uniterms

Acrylic resin; biological compatibility; light microscopy.

Introduction

The development of dental materials is growing every year, as well as their use in many specialties. Among the dental materials, acrylic resins have important applications, mainly on dental and maxillofacial prosthesis. Their easy manipulation and usage collaborate in order to disseminate their indication.

These materials need to be exhaustively studied in order to get better knowledge of their biological, physical and chemical properties. This is particularly important when it is considered that these materials can be put in direct contact with living tissues, for example, during the reconstruction of cranial and facial bones, and in this case biocompatibility is the goal to be reached[2,4,5,13]. This goal is reached when a maximal efficiency and a minimal interference on the local dynamics of the tissues is achieved.

Despite this importance, few experimental studies were realized with acrylic resins utilized for prosthesis and those who analyzed it observed an adequate tissue reaction resulting in a good biological condition[3,6,7,10-12].

In the last twenty years, new resins are being developed, as the visible light-cured (VLC) ones. Reportedly, these denture-bases have shown a good level of biocompatibility[1,8,14]. The purpose of this study was to compare one of these VLC to a conventional colorless heat-cured resin (HC).

Material and methods

Twelve adult and male Wistar rats (*Rattus novergicus*) were used in this study. The rats were randomly divided in four groups of three animals, which corresponded to the four experimental times.

Both the heat cured (HC) resin (Clássico Artigos Odontológicos, São Paulo, SP) and the visible light cured (VLC) resin (Dentsply, Petrópolis, RJ) were used to make twelve discs with 6 mm diameter and 1 mm thickness. The twenty-four specimens were polished and were finished to avoid round edges. These discs were also accurately cleaned in order to eliminate all of the polishing residues after incubation in distilled water for 24 hours. After this period, the discs were disinfected in hydrogen peroxide for 5 minutes and kept in a sterile recipient for 20 days, to avoid any influence of the residual monomer[7,11].

Rats were anesthetized intraperitoneally with nembutal (0,5%), cloralhidratum (33%) and distilled water, in the dosage of 0,1ml of corporal weight. The dorsum of animal was thricotomized and local asepsis was realized with alcohol 70 GL. An incision of 8mm was made and after divulsion, the resin specimens were introduced in the connective tissue, being one disc of each resin in each side of the animal, always distant from the incision. Rats were kept in physiological conditions during all experiment.

After 7, 14, 21 and 28 days the animals were sacrificed by sulphur eter inhalation. The discs were removed with the tissue around and fixed in Bouin. After 24 hours the disc was removed and the tissue was conventionally processed (parafin inclusion), and stained by haematoxylin and eosin (H.E.), as well as Mallory's trichromic, for light microscopy observation.

Results

At 7 days, it was observed predominantly a cellular tissue, mainly represented by young fibroblasts, suggesting a great secretion activity around the resin discs. The presence of mononuclear infiltrate, and a great number of young capillaries was observed beside a discrete deposition of collagen fibers in both samples, evolving the specimens (Figure 1).

A milder reaction was noticed in relation to VLC resin when compared to HC, since a minor number of cells and a major deposition of collagen fibers was observed in continuity with the surrounding tissue. By 14 days, the surrounding tissue wasn't already mature. A great number of fibroblasts (fibrocits) around the VLC, indicated a faster maturation, being more defined around the VLC, than around HC. It suggests, at this time, the organization of a capsule around the resin specimens.

At 21 days the histological aspects resembled the samples of 28 days, when the surrounding tissue of the resin specimens, were very similar for both types of resin (Figure 2). Compacted fibers and a thinner capsule were observed around the VLC at 28 days when compared to the same group at 21 days and to the HC at the end of the experiment (28 days).

The histological aspects observed on our model suggested a good level of biocompatibility of both materials and a tissue healing within normal patterns with the presence of a mature capsule of fibrous tissue.

Discussion

A strange body introduced on the intimacy of a connective tissue, can be either eliminated or destructed[5,6,11]. Otherwise, it can remain, encapsulated or incorporated by the tissues of the host. Our results indicated that the both resins were encapsulated by a connective fibrous tissue.

At 14 days, a well defined connective capsule was observed, as some authors noticed with a HC resin[7,9,10,11]. The capsule was more defined around the VLC in contrast with a protacted maturation of the HC at same time. At 21 days, the VLC presented a similar picture to that observed at 28 days with the HC and at 28 days, both resins resulted in similar observations, which is referred by others authors, even in longer times of observation[3,6,7,10,11]. Stinson[12] (1964) observed a different reaction at 28 days, characterized by two zones probably related to the size of the implanted specimen. Podshadley & Harrison[9] (1966) also observed a connective capsule with scarce inflammatory cells, around six different materials, polished or not.

The thickness of the capsule can give us some elements to observe the evolution of the healing process. So, basic histopathology revealed a good biocompatibility level of both resins, demonstrating only a moderate to discrete variation on the healing process at 28 days.

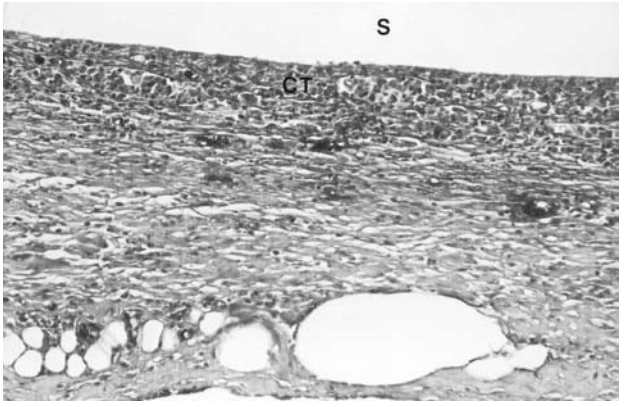

FIGURE 1 – Connective tissue (CT) envolving the light-cured denture base material space (S), at 7 days after implantation. (H.E., magnification X 140).

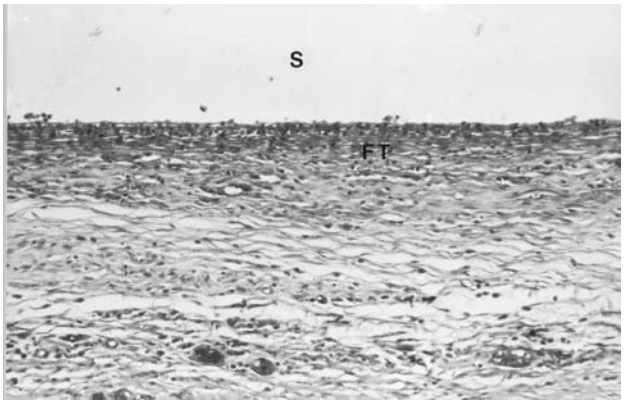

FIGURE 2 – Capsule of fibrous tissue (FT) envolving the light-cured denture base material space (S), at 28 days after implantation (H.E., magnification X 140).

Conclusions

The probe discs studied either of VLC or CHC resins were considered adequate to be used on living tissues. In the studied model slight differences were observed as the VLC, which demonstrated a more compatible reaction compared to CHC in the different times studied.

Resumo

O objetivo deste trabalho foi avaliar a compatibilidade de biológica de materiais usados na confecção de aparelhos protéticos. Foram testadas uma resina incolor ativada termicamente e uma resina rosa ativada por luz visível. Discos destas resinas foram implantados no tecido conjuntivo do dorso de 12 ratos Wistar. Os animais foram sacrificados em 7, 14, 21 e 28 dias após a implantação. Os cortes foram preparados para observação em microscopia de luz. Observou-se que as duas resinas demonstraram bom nível de compatibilidade no tecido conjuntivo.

Unitermos

Resina acrílica; biocompatibilidade; microscopia de luz.

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Corresponding author:
Sigmar de Mello Rode
e-mail: sigmar@fosjc.org.br
R. Eng. Francisco José Longo, 777
São José dos Campos – SP – Brazil – Zip Code:12.245-000