PROPLAST IMPLANTATION INTO RAT DENTAL SOCKETS

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SAAD NETO, M., CARVALHO, A.C.P. & OKAMOTO, T. — Proplast implantation into rat dental sockets. **Rev. Odont. UNESP, 8/9**:27-33, 1979/1980.

SUMMARY: Fragments 1x1x3 mm of sterilized proplast were grafted into dental sockets. It was found that material did not provoke an inflammatory reaction and only slightly delayed the healing process. Connective tissue and bone trabecula newformation occur within the pores of proplast. The material is incorporated by the dental socket.

KEY WORDS: Proplast, healing socket, implants.

With the aim to reconstruct jaw defects some alloplastic materials (ALEXANDER, 1976; CARVALHO and OKAMOTO, 1978) and grafts (CARVALHO and OKAMOTO, 1979) have been experimented.

Prorplast, a recent and biocompatible alloplastic material, presents the desired requisites for implantation (KENT *et al.*, 1972). This material is composed by Teflon and carbon fibers. It is generally related to a rapid proliferation within its pores (KENT *et al.*, 1972; RHINELANDER and NELSON, 1974; KENT *et al.*, 1975; MARTIN, 1976; SCHENCK and TOMLINSON, 1977; KOSOY *et al.*, 1977; MISCHKE *et al.*, 1977) and absence of inflammatory reaction (KENT *et al.*, 1972; JANEKE *et al.*, 1974; MARTIN, 1976; MISCHKE *et al.*, 1977).

As dental extraction is the most common surgery practiced by dentists, experiments with small grafts or intra-alveolar alloplastic materials have been perfomed (CARVALHO and OKAMOTO, 1978) since the dental alveolus differs from other bone cavities once because it already contains connective tissue (CARVALHO and OKAMOTO, 1978; CARVALHO and OKAMOTO, 1979),

Thus, it is desirable to continue the studies to select an alloplastic material with satisfactory properties to avoid or to correct a deficient

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alveolar ridge (CARVALHO and OKAMOTO, 1978), what led us to study the socket healing after Proplast implantation.

Material and Method

There were used 32 male albino rats weighing 100-200g.

Under general anesthesia with Pentobarbital sodium, administered intraperitoneally, the right upper incisors from all the animals were extracted (OKAMOTO and RUSSO, 1973). Fragments 1x1x3mm of sterilized Proplast (Vitek Incorporated, U.S.A.) were grafted into dental sockets and the gingiva was sutured with no. 3-0 black silk (Sutupak-Ethicon, Johnson & Johnson).

The animals received a single dose of Penicillin G Benzatin (Benzetacil K-400, Fontoura Wyeth).

During the whole experimental period, the animals received standard food and water *ad libitum*, and then they were killed in groups of four, after 1, 3, 6, 9, 15, 21, 60 and 90 postoperative days.

In order to obtain blocks containing the dental sockets, the right maxilla was separated from the left one and the pieces were fixed in a 10 per cent formalin solution, decalcified in a formic acid-sodium citrate solution and embedded in paraffin in vaccuo. The blocks were then cut serially 6 micrometers thick.

The tissue sections were stained with hematoxylin and eosin and by trichromic Masson's for morphologic studies.

Results

On the lst postoperative day, the socket was filled with a blood clot. The material implanted was located between the middle and apical thirds and showed blood clot into the pores of the material.

Near the lingual cortical bone and in contact with the implant there were vestiges of a well vascularized periodontal ligament, and at the apical third fibroblasts and numerous macrophages were noted invading the blood clot.

By the 3rd postoperative day, the material was between the middle and apical thirds. In this area, around the implant, numerous fibroblasts and capillaries were seen. Several macrophages with pigments of hemossiderin within their citoplasm were still noticed. Some lymphocytes were also present. The alveolar crest in both buccal and lingual surfaces was intact. Acute and chronic inflammatory reactions were found near the gingival margin.

By the 6th postoperative day, the Proplast was still located between the middle and apical thirds. At the apical third of the socket and near the cortical bone, thin newly formed bone trabeculae were found. The Proplast was surrounded by fibroblasts and capillaries and there was fibroblast proliferation inside their pores.

On the 9th postoperative day, the material pores were filled with fibroblasts and capillaries (fig. 1). The newly formed bone trabeculae filled the apical half of each socket but they were not well organized. The gingival margin occluded the dental sockets.

By the 15th postoperative day, the Proplast pores were filled with bone trabeculae and or with connective tissue. At the level of the middle and apical thirds many bone trabeculae were observed. The alveolar crest showed areas of newbone formation.

By the 21th postoperative day the bone trabeculae within the material pores was considerably increased (fig. 2). However, areas of conective tissue without bone differentiation were still found. Generally the apical half of each socket was filled by thick bone trabeculae. At the level of the cervical third the trabeculae were newformed.

By the 60th postoperative day, the socket was filled by osseous trabeculae exhibiting thin spaces between them (fig. 3). Irregular trabeculae were still noted within the material pores, but in some areas only connective tissue was observed, without bone differentiation (fig. 4).

On the 90th postoroperative day, the morphological aspect was similar to the described for the previous group. There was an evident increase of trabeculae within the material pores, but an irregular disposition of them still persisted (fig. 5).

Discussion

The absence of acute inflammatory reaction near the Proplast was already reported by other authors (KENT *et al.*, 1972; RHINELANDER and NELSON, 1974; AREM and MADDEN, 1976; SCHENCK and TOMLINSON, 1977).

The Proplast stayed at the middle or apical thirds of the dental socket, as reported by JANEKE *et al.* (1974). Its location above the apical third probably is determined either by the blood pressure provoked by the post-extraction hemorrhage or by the suction on it, during the removal of the instrument used to implant the material into the dental socket.

The rapid connective tissue proliferation whithin the pores of the implant corroborated the observations of KENT *et al.* (1972). Probably the irregular arrangement of the newformed osseous trabeculae results in the conformation of the interconnecting pores.

RHINELANDER and NELSON (1974) observed some bone spicules limited to the superficial edges of the implant, while MARTIN (1976) and HALSTEAD *et al.* (1979) did not observe newbone formation within the Proplast. KENT *et al.* (1972) observed only osteoid tissue.

Thus, this apparently contradictory findings can be justified, considering that in the larger pieces is dificcult to occur differentiation of the newformed tissues inside the deeper pores, due to the absence of blood clot in this portion; in our experiment, the Proplast pores were pratically filled by osseous trabeculae. This can be explained by the small size of the piece, its embedding by the blood clot and its location near to bone walls that were presenting osteogenic activity.

In considering that 75% of Proplast pores are larger than 200 micrometers (MARTIN, 1976; FREEMAN, 1976) and that this size permits the osseous newformation (MARTIN, 1976), we can believe that these and other factors justified the almost complete fulfillment of the pores by osseous trabeculae. On the other hand, we did not observe bone resorption, in agreement with JANEKE *et al.* (1974) data, even when the material was placed near to bone tissue.

The presence of any foreign material in the dental alveolus alters the chronology of the healing process, either interfering with the formation of the blood clot and causing changes in the periodontal ligament (CARVALHO and OKAMOTO, 1979) or causing resorption of the alveolar cortical bone (SANCHES *et al.*, 1972; OKAMOTO

et al., 1973). The periodontal ligament has an important role on the healing of extraction wound (OKAMOTO and RUSSO, 1973; CARVALHO and OKAMOTO, 1979).

We did not see any changes in the formation of the blood clot or in the remmants of the periodontal ligament, even when in close contact with the material, it seems that Proplast is not an irritant material when placed into the dental socket.

Thus, differently of other investigations performed with the same methodology and other types of materials (CARVALHO and OKAMOTO, 1978), we noted that the delay in the evolution of the healing process persisted only at the level of the cervical third of the dental socket. However, we believe that this delay instead to be caused by the material was due to traumatic and consequent inflammatory events occurring at this portion of the socket.

In spite of the care which one can take to avoid the contact with oral fluids during the intra-alveolar implantation and the gingival coaptation after dental extractions, the microorganisms of the oral cavity can contaminate the material causing its elimination or inflammatory reaction of the tissues (KENT *et al.*, 1972; KENT *et al.*, 1975; JANEKE and SHEA, 1976).

In comparison to other materials successfully implanted into dental sockets such as sponge of polyvinyl alcohol (SANTOS PINTO *et al.*, 1969), anorganic bone (SANCHES *et al.*, 1972), polyurethane (OKAMOTO *et al.*, 1973), and gelatin sponge (SAAD-NETO *et al.*, 1975), Proplast exhibited still better results.

It is our opinion that Proplast used according to the manufacturer's direction may be implanted into dental sockets after extractions. We believe that this material can help the maintenance of the alveolar ridge contour because it is incorporated to the dental socket.

Summary and Conclusions

The purpose of this study was to verify the healing process of dental extraction wounds in rats following Proplast implantation.

Thirty-two albino rats were used and were killed from 1 to 90 days. It was possible to conclude that: (1) the material does not provoke inflammatory reactions when used in dental sockets; (2) connective tissue and bone trabecula newformation occur within the pores of Proplast; (3) the chronological evolution of the healing process is lightly delayed; (4) the material is incorporated by the dental socket.

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Foi objetivo deste trabalho, verificar histologicamente o processo de feridas de extração dental em ratos, após o implante de Proplast.

Foram usados 32 ratos albinos, sacrificados em grupos de 4 animais, aos 1, 3, 6, 9, 15, 21, 60 e 90 dias pós operatórios.

Foi possível concluir-se que: (1) o material não provoca reação inflamatória quando usado no alvéolo dental; (2) no interior dos poros do proplast desenvolvem-se tecido conjuntivo e trabéculas ósseas; (3) a cronologia do reparo alveolar é ligeiramente retardada; (4) o material é incorporado pelo alvéolo dental.

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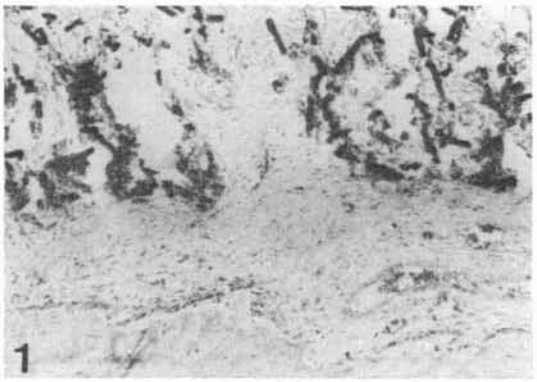
LEGENDS

Fig. 1. Connective tissue newformed within the pores of Proplast (9 days, H.E. X 100).
Fig. 2. Bone trabeculae (B) within the mate rial pores (21 days, Trichromic Masson's X 48).
Fig. 3. Irregular bone trabecula spaces (60 days, Trichromic Masson's X 72).
Fig. 4. Bone trabecula (B) and connective tissue without bone differentiation within the proplast (60 days, Trichromic Masson's X 100).
Fig. 5. Bone trabecula (B) filling the pores of Proplast and in contact with the cortical (C) bone (90 days, Trichromic Masson's X 48).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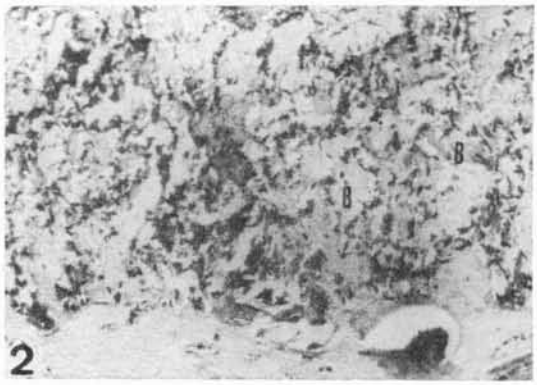
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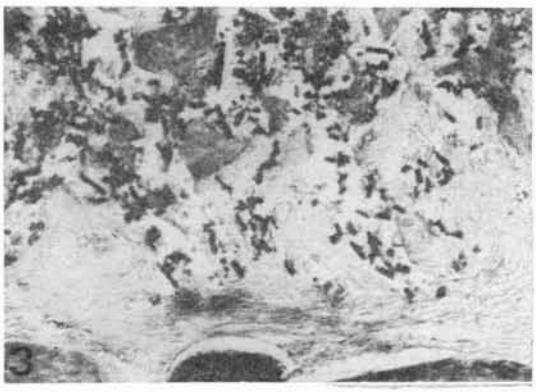
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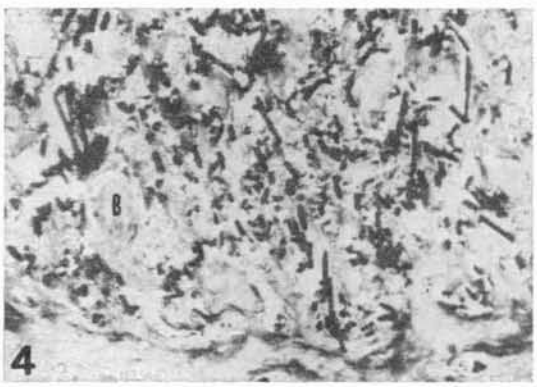
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