<Review Article>

Scientific Evidence for Autogenous Tooth Bone Graft Material (AutoBT)

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• Abstract

The experimental assessment of autogenous tooth bone graft material (AutoBT) was conducted. Several studies on autogenous tooth bone graft material have confirmed the resorption of AutoBT over time and the formation of high-quality new bone.

• Keywords : autogenous tooth bone graft

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Introduction

Since 1999, reports of clinical and experimental research using tooth ash powder as bone graft material have been featured in several international journals. This material has also been referred to as tooth ash or particulate dentin. Clinically, a combination of particulate dentin and plaster of Paris was used to fill the defect remaining after the extraction of a cyst in 10 patients, with average follow-up period of 52.2 months[1, 2]. Studies have been conducted on animals to assess the use of xenogeneic bone (Bio-Oss)[3] especially with regard to the healing process after grafting in a defect area around implants[4], its application in combination with platelet-rich plasma[4], the healing process of grafted defects after inducing

osteoporosis[5], its application in combination with tissue adhesives[6], its application in combination with chitosan[7], and the healing process after guided bone regeneration[8-10]. Tooth ash powder was confirmed to be an osseoinductive graft material with excellent biocompatibility[11-16].

Reports in international journals

1) Particulate dentin-plaster of Paris combination for the grafting of large defects in the jaw[1]

A total of 10 patients who had received grafts with a combination of particulate dentin-plaster of Paris (mixed at 2:1) after the extraction of a cyst were examined retrospectively. The size of the defect area was larger than 20 mm in all cases, and the follow-up observation period was 50~57months (average: 52.2). Postsurgical wound dehiscence and complications due to infection developed in three patients; nonetheless, they healed well after resuturing using the buccal mucosal flap or incision and drainage. The bone graft materials were convenient to use, with long-term radiological and clinical observations demonstrating their excellent biocompatibility.

2) Combined implantation of particulate dentine and plaster of Paris and bone xenograft (Bio-Oss) for bone regeneration in rats[3]

To evaluate several different graft materials, rats were divided into one control group, which received no graft (group 5), and four grafted groups receiving a 2:1 mixture of particulate dentin and plaster of Paris (group 1), a 2:1:1 mixture of particulate dentin, plaster of Paris, and Bio-Oss (group 2), a 1:1 mixture of plaster of Paris and Bio-Oss (group 3), or Bio-Oss only (group 4). After 8 and 16 weeks, samples were collected and examined histologically and histomorphometrically. Newly formed bone was most abundant with the use of Bio-Oss only (group 4). Although the combination of particulate dentin and plaster of Paris resulted in slightly less bone healing compared to Bio-Oss, the combination was reported to be osseoconductive and biocompatible.

3) Particulate dentin-plaster of Paris combination with or without platelet-rich plasma in the treatment of bone defects around implants[4]

Three round bone defects were induced in the ileum of adult dogs, with a screw-type implant (diameter: 4mm; length: 10mm) placed at the center of the defect. The animals were divided into a control group (group 1) and two experimental groups grafted with a particulate dentin-plaster of Paris combination (group 2) or with a particulate dentin-plaster of Paris combination plus platelet-rich plasma (group 3). Histological observations revealed new bone filling the entire defect area in groups 2 and 3 and even better results with platelet-rich plasma. The particulate dentin-plaster of Paris combination was directly integrated with new bone, and newly formed bone was in direct contact with the implant.

4) Bone formation in ovariectomized rats after implantation of tooth ash and plaster of Paris mixture[5]

A defect with diameter of 8mm was induced in the cranium of 60 rats. The rats were divided into four groups: ovariectomized with no bone graft (group 1); ovariectomized with a tooth ash-plaster of Paris combination graft (group 2); no ovariectomy and no bone graft (group 3); and no ovariectomy with a tooth ash-plaster of Paris combination graft (group 4). The rats were sacrificed after 4, 8, and 16 weeks, and histological examinations were performed. The amount of new bone formation was greater in the groups without ovariectomy than that in the ovariectomized groups. On the other hand, bone formation was better in the tooth ash-plaster of Paris grafted groups compared to the control groups. In other words, ovariectomy was apparently a negative factor in the formation of new bone, with the tooth ash-plaster of Paris combination an effective bone graft material.

5) Particulate dentin-plaster of Paris combination with and without fibrin glue in the treatment of bone defects around implants[6]

A round bone defect was induced in the ileum of four dogs. A total of 24 implants with three exposed screws were placed at the center of the defects. There were three groups: control (group 1); grafted with a particulate dentin-plaster of

Paris combination (group 2), and; grafted with a particulate dentin-plaster of Paris combination plus fibrin glue (group 3). After 4 and 8weeks, the animals were sacrificed. The implants and adjacent bones were collected and evaluated histologically. Compared with the control, groups 2 and 3 showed better bone healing. In particular, better healing was observed in group 3 than in group 2.

6) Osteogenic activity of the mixture of chitosan and particulate dentin[7]

A bone defect with diameter of 8mm was induced in the cranium of 75 rats. The animals were divided into a control group (group 1) and four experimental groups that received the following graft materials: pig particulate dentin (group 2); pig particulate dentin plus plaster of Paris (group 3); pig particulate dentin plus chitosan (group 4), and; chitosan only (group 5). Tissue samples were collected 2, 4, 8, and 12weeks after the placement of the graft. Compared to the control group, all of the experimental groups including the chitosan group showed excellent new bone formation.

7) Particulate dentin as a bone grafting material[8]

A mixture of particulate dentin and plaster of Paris was evaluated as a bone substitute in rats, pigs, rabbits, and dogs. The particulate dentin was prepared from teeth extracted from humans. A bone defect with diameter of 8mm was induced in each animal, and the defect was grafted with the particulate dentin/plaster of Paris combination. Histological analyses performed 6 and 12weeks later revealed that the bone defects in all study animals were filled with new bone. In addition, the particulate dentin was not cytotoxic, and no abnormal reaction was detected in a hypersensitivity test.

8) Guided tissue regeneration using a mixture of human tooth ash and plaster of Paris in dogs[9]

This study examined the osteoinductive effects of a mixture of tooth ash and plaster of Paris as graft material in the treatment of class II furcation defects in adult dogs. Class II furcation defects were induced in the mandibular premolar area. In the control group, the defect was covered with only the absorbable membrane BioGide. In the experimental group, the defect was grafted using a tooth ash-plaster of Paris mixture, and then covered with BioGide membrane. Samples for histological tests were harvested 4 and 8weeks later. The formation of new lamellar bone and enamel was observed in the experimental group as well as better regeneration of periodontal ligaments compared to the control.

Discussion

Autogenous tooth bone graft material is safer than graft materials from allogeneic or xenogeneic teeth because the autogenous material comes from the patient's own body. In addition, autogenous tooth bone graft material contains both inorganic and organic substances, promotes bone healing, and exhibits excellent osteoinduction and osteoconduction. In histological tests, healing adjacent to autologous bone grafts has been observed; thus confirming the safety of autogenous tooth bone graft material.

Although some investigators have claimed that the available studies on autologous tooth bone graft material are insufficient to support its clinical application, many studies conducted since 1993 have demonstrated the safety and osteoconductive capacity of allogeneic and xenogeneic tooth ash powders burned at high temperature (950℃) to suppress any potential immune response. Furthermore, these have been shown to be biocompatible bone graft materials. Nevertheless, these have not been commercialized because of the legal limitations in Korea including medical waste extraction laws governing human teeth[1,2].

Conclusions

Several studies on autogenous tooth bone graft material have confirmed the resorption of autogenous tooth bone graft material over time and the formation of high-quality new bone.

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