Oral Implant Treatment with Guided Bone Regeneration (GBR) Using an Atelocollagen Sponge and Barrier Membrane after Extirpation of Ossifying Fibroma

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Abstract

Constructive operation of jaw bone for implant treatment becomes complex depending on the defect area of the bone getting larger and giving patients pain. We encountered a case of implant treatment after operation of ossifying fibroma in a 28-year-old Japanese woman. One-piece of the implant used in the treatment was able to restore the mastication and aesthetical problem of the second premolar and first molar. In addition, the atelocollagen sponge and barrier membrane used together in the treatment also improved the prognosis of the implant treatment.

Introduction

Various therapeutic methods such as guided bone regeneration (GBR) and sinus lift have been implemented based upon improvements in implant treatment (1-4). As the reconstruction of the jaw is complicated and burdens the patients with physical stress depending on the size of the bone defects, the concept of a technique for the minimum limit of stress is necessary for implant treatment.

Ossifying fibroma, classified into bone-related lesions in odontogenic tumors, affects the jaw and causes bone loss (5), therefore, bone regeneration and prosthodontics after surgery of the tumor are needed for the complete restoration (6, 7). However, implant treatment of GBR using an atelocollagen sponge and barrier membrane for ossifying fibroma has not been performed as of yet.

We encountered an implant case with tooth extraction and ossifying fibroma and obtained an improved prognosis by making planning and performing a unique method, therefore, interesting and important knowledge is described in this report.

Case summary

The patient provided informed consent after the sum-

mary and purpose of the case report was explained to her.

1) Clinical course and extirpation of tumorous lesion

A 28-year-old woman visited our dental clinic with a chief complaint of diffuse pain of the teeth. There were no particular familial or medical histories. A radiolucent tumorous lesion with slight expansion was found in the second premolar-to-first molar region of the left-mandible (Fig.1a). There was no evidence of root resorption. The second premolar tooth and mesial root of the first molar tooth were extracted, and the tumorous lesion was extirpated from the socket of the tooth extraction under local anesthesia. After bone elimination, a shell-shape atelocollagen sponge (M size; TERUMO, Tokyo, Japan) was inserted into the extirpated-defect area and the surface was covered with a resorbable barrier membrane (GORE-TEXTM, R6, W.L.Gore and Associates Inc., USA).

Histopathologically, the extirpated lesion consisted of proliferating fibroblastic cells with an irregularly bundle-like arrangement and formation of bony and cementum-like hard tissues, corresponding to ossifying fibroma as a definitive diagnosis (Fig.1b). The hard tissues resembled woven bone and/or cellular and acellular cementum adjacent to the proliferating fibroblastic cells.

2) Treatment of implant and GBR

There were no particular symptoms for 5 months after the extirpation of the tumor, therefore, implant treatment

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Fig. 1. (a) Panorama tomography at the first medical examination. Well-demarcated radiolucent lesion (arrows) is observed in the left side of the mandible. (b) Histopathological feature of ossifying fibroma. The tumor consists of proliferating fibroblastic cells and woven bone formation. (bar, 20 μ m)

Fig. 3. (a) Result of periosteal (b) Stable state of the bone around the implant at 8 weeks after the operation (arrows, area of the surgery).

Fig. 2. (a) Panorama tomography at the state after the tooth extraction and extirpation of the tumor. Radiopaque feature (arrows) is found the area of the tumor in the left side of the mandible. (b) Removed cylindrical specimen of the bone in the area of extirpation of the tumor. Relatively mature bone formation is appeared. (c) High power view of the removed specimen. The mature bone formation involves osteocytes in the lacune and lining with osteoblasts at the periphery. (bar, 20 μ m)

Fig. 4. (a) Panorama tomography in the postoperative state of the implant treatment. (b) The state of transplantation of the implants. (c) The final state of the implant treatment showing buccal and lingual (mirror) view.

and GBR were performed in the area of the extracted premolar and molar teeth. Under local anesthesia, after dissection of the alveolar mucosa, the periosteum was abraded from the distal area of the first premolar to the first molar region of the left mandible. Although the extirpated area of the tumor was filled with bone formation, collapse was slightly observed in the alveolar mucosa of the mesial side of the first molar (Fig.2a). After a cylindrical tissue block (length, 10mm) was resected from the alveolar bone region using a Hollow Cylinder[®] (Straumann, Swiss; 2.5mm in diameter), two pieces of the HA-coated one-piece type implant (AQB implant[®], 4mm in diameter, 19mm in length) (ADVANCE, Tokyo, Japan) were implanted in the extirpated area of the tumor. In order to consider the aesthetic appreciation for upper construction of the implant, bone fragments obtained from the patient were filled in the buccal area of the alveolar bone showed slight bone-loss with a bone trap cylinder[®] (INPLATEX, Sweden). After that, the surface of the alveolar bone was covered with a non-resorbable barrier membrane (e-PTFE membrane; GORE-TEXTM R6, W.L.Gore and Associates Inc., USA) penetrated through the implants, and obtained close fixation between the membrane and the implants. Finally, the dissected mucosa was sutured using GORE-TEX SUTURE[®] (CV-5, W.L.Gore and Associates Inc., USA).

3) Progress and prognosis

Histopathological examination (biopsy) was performed before the implant treatment in order to evaluate the condition in the extirpated area. The histopathological specimen obtained at 5 months after the extirpation of the tumor showed relatively mature, trabecular bone formation in the extirpated area (Fig.2b,c).

In order to examine the condition of the implant area, a Periotest[®] (Siemens, Germany) was performed in the areas of the second premolar and first molar each week from immediately following to 8 weeks after the implant treatment (Fig.3a). Although the data exhibited a high level at immediately after the implant treatment, it gradually decreased and reached a minimum level at 8 weeks, and bone regeneration was almost stable in the area of the surgery (Fig.3b).

As the e-PTFE membrane was partly exposed, 0.2% chlorhexidine (KENEI Pharmaceutical, Osaka, Japan) was used as a gargle for 2 weeks in order to protect against infection and for oral hygiene. The reason why 2%

chlorhexidine was not used in the present case was to avoid adverse effects such as hairy tongue, discoloration of teeth, urticaria, and so on, and effectiveness of 0.2% chlorhexidine for oral hygiene could be expected. After the dissection of the alveolar mucosa, the e-PTFE membrane was removed under local anesthesia at 1 month after the implant treatment. Bone formation was observed in the area underneath the membrane. Finally, the dissected mucosa was sutured. The final status is shown in Fig.4a-c.

Discussion

The present case reached to obtain effective prosthodontical restoration of implant treatment at a total of 7 months after surgery of ossifying fibroma. In the present case, the implant treatment started at 5 months after the surgery. The reason was consideration of the possibility of recurrence of the tumor. As the extirpated site showed radiopaque features suggesting bone formation at 5 months, the implant treatment was started.

As far as we know, there have been no case reports about the implant treatment of GBR being used with an atelocollagen sponge and resorbable barrier membrane after the surgery of ossifying fibroma. Although some case reports have been published on reconstruction and implant treatment after resection of odontogenic tumors such as odontogenic myxoma (8), ameloblastoma (9) and large complex odontoma (10), these cases received reconstruction with non-resorbable stents and autogenous iliac bone grafts. Aggressive resection is the most effective treatment because ameloblastoma and odontogenic myxoma, especially, show local invasive growth and have a possibility of major destruction surrounding the bone and teeth. However, the case report of the odontoma was of a large tumor. Therefore, an autogenous iliac bone graft might be adequate for these cases after resection of the tumors. In the present case, the tumor, which was definitively diagnosed as an ossifying fibroma, was completely resected at a minimum aggressive approach and no recurrence of the tumor has been confirmed, to date. The present results suggest that implant treatment with an atelocollagen sponge resorbable barrier membrane after surgery is an adequate method for local resection from a viewpoint of restorative treatment.

Several investigators reported that the atelocollagen sponge is not only resorbable and non-immunogenic but also provides a three-dimensional structure scaffold for new bone formation (11-13). In the present case, filling the

atelocollagen sponge in the defect of tooth extraction and extirpation of the tumor, and covering the alveolar mucosa with a resorbable barrier membrane protected the bone during the extraction of the second premolar and first molar, and the vertical bone resorption. Several investigators have indicated that an absorbable membrane is good for autografts or other grafting materials as a scaffold for the membrane, whereas non-resorbable membranes are able to promote bone regeneration without bone graft materials in dehiscence defects (14-16). Thus, the present results could explain that the application is able not only easier for the following operation, but also provides aesthetic appreciation for implant construction.

Histopathologically, the tumor consisted of proliferating fibroblastic cells and woven bone- and/or cementum-like hard tissues, corresponding to a ossifying fibroma (5). The fibroblastic tumor cells showed relatively cellular arrangements but no atypical changes, such as mitotic figures, hyperchromatism, or marked pleomorphism, indicating the characteristics of a benign tumor. Histopathological examination was also performed at 5 months after the extirpation of the tumor. The findings exhibited relatively mature bone formation compared to the woven bone-like hard tissue of the tumor, with trabecular and cortex-like arrangements involving osteocytes and the periphery of the forming bone lining with osteoblasts, and also found relatively radiopaque findings. These results suggest that the use of an atelocollagen sponge and barrier membrane could provide an improved prognosis and bone regeneration in the defect area by surgery (11-16).

The present case could also obtain complete wound healing and close attachment of the surgically injured tissues and resorbable barrier membrane in GBR. We thought that if a non-resorbable membrane was used, the membrane would be easy to be exposed without close attachment to the injured tissues, causing bacterial infection (17). In transplantation of the implant compared to GBR, a non-resorbable barrier membrane was applied. The purpose of the non-barrier membrane was in expectation and for confirmation of bone formation and regeneration in the cervical area of the implants before the setting of the upper construction.

As a HA-coated Titanium implant (AQB implant®) was used in the present case it could be receive rapid approval. The results of the Periostest®, gradually decreased and reached a minimum level at 8 weeks after the surgery.

These results also support that the implant system could provide smooth osseointegration and protect the tissues around the implant from bacterial infection and inflammation.

In the present operation of implant transplantation, the degree of defect was little, and it was easy to perform GBR to accelerate bone formation and regeneration. If the defect was remarkable, the operation could be more complex, such as our previous report (18). Therefore, we conclude that, for obtaining high quality of implant treatment with extirpation of tumor and tooth extraction, the planning of the treatment should be considered to consider the minimum level of bone loss by extirpation and extraction.

References

1. Becker W, Becker B: Guided tissue regeneration for implants into extraction sockets and for implants dehiscences, *Int J Periodont Dent*, 10: 377-391, 1990.
2. Hotta Y: Recovery of alveolar bone by the guided bone regeneration technique, *J Oral Implantol*, 22, 138-146, 1996.
3. Ahmed MS, Askar NA: Combined bony closure of oroantral and sinus lift with mandibular bone grafts for subsequent dental implant placement, *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, 114, e8-14, 2011.
4. Simonpieri A, Del Corso M, Vervelle A, Jimbo R, Inchingolo F, Sammartino G, Dohan Ehrenfest DM: Current knowledge and perspectives for the use of platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) in oral and maxillofacial surgery. Part 2: Bone graft, implant and reconstructive surgery, *Curr Pharm Biotechnol*, [Epub ahead of print].
5. Barnes L, Eveson JW, Reichart P, Sidransky (Edited): *World Health Organization Classification of Tumours, Pathology & Genetics, Head and Neck Tumours, Salivary Glands*, IARC press, Lyon, 2005, p.319-320.
6. Gurol M, Uckan S, Guler N, Yatmaz PI: Surgical and reconstructive treatment of a large ossifying fibroma of the mandible in a retrognathic patient, *J Oral Maxillofac Surg*, 59, 1097-1100, 2001.
7. Troulis MJ, Williams WB, Kaban LB: Staged protocol for resection, skeletal reconstruction, and oral rehabilitation of children with jaw tumors, *J Oral Maxillofac Surg*, 62, 335-343, 2004.
8. Kawata T: A case of prosthetic reconstruction using autogenous bone graft and dental implants for maxillary defect following myxoma extirpation. *J Jpn Prosthodont Soc*, 51, 332-335, 2007.
9. Minichetti JC, D'Amore JC, Schwartz E: Complete oral rehabilitation of a postresection ameloblastoma patient: a clinical case report. *J Oral Implantol*, 37, 735-744, 2011.

10. Utumi ER, Cremonini CC, Pedron IG, Zambon CE, Cavalcanti MGP, Cecchetti MM: Maxillary reconstruction with particulate bone graft and titanium mesh: a treatment option for large complex odontoma of the maxilla. *J Dent Child*, 78, 124-128, 2011.
11. Mukozawa A, Ueki K, Mrukawa K, Okabe K, Moroi A, Nakagawa K: Bone healing of critical-sized nasal defects in rabbits by statins in two different carriers, *Clin Oral Impl Res*, 2011 [Epub ahead of print].
12. Wong RW, Rabie AB: Histological and ultrastructural study on statin graft in rabbit skulls, *J Oral Maxillofac Surg*, 63, 1515-1521, 2005.
13. Kawaguchi Y, Kondo E, Kitamura N, Arakaki K, Tanaka Y, Munekata M, Nagai N, Yasuda K: In vivo effects of isolated implantation of salmon-derived crosslinked atelocollagen sponge into an osteochondral defect, *J Mater Sci*, 22, 397-404, 2011.
14. Park S-Y, Kye S-B, Yang S-M, Shin S-Y: The effect of non-resorbable membrane on buccal healing at an immediate implant site: an experimental study in dogs, *Clin Oral Impl Res*, 22, 289-294, 2011.
15. Esposito M, Grusovin MG, Worthington HV, Coulthard P: Interventions for replacing missing teeth; bone augmentation techniques for dental implant treatment, *Cochrane Database of Systematic Reviews*, 25, CD003607, 2006.
16. Chiapasco M and Zaniboni M: Clinical outcomes of GBR procedures to correct peri-implant dehiscences and fenestrations; a symptomatic review, *Clin Oral Impl Res*, 20, 113-123, 2009.
17. Okuda K, Yoshie H: GTR method. In Miyata T, Tatsumi J, editors. *Periodontal disease and bone science-the view from bone metabolism to implantology*. Ishiyaku Publishers, Tokyo, Japan, 2002, p.127-132.
18. Hayashi M, Nakamura T, Matsuda T, Yamamoto H, Kawahara H: A case of early functional recovery using one-piece screw implants with GBR, Titanium plate and autogenous bone grafts after radicular cyst-extirpation, *J Jpn Soc Oral Implant*, 13, 708-714, 2000.