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CASE REPORT

Socket Preservation with Alloplast: Discussion and a Descriptive Case

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ABSTRACT

Soon after tooth extraction the bone resorption takes place reducing the height and width of alveolar ridge. This produces an altered morphology of the bone unfavorable for implant placement and implant placement becomes impossible without surgical correction. Socket grafting maintains and preserves ridge for implant placement.

Keywords: Socket preservation, CPS putty (Novabone), Implant.

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INTRODUCTION

After a tooth extraction a cascade of healing process starts which results in 25% bone resorption.[1,2] This healing process hampers implant placement due to insufficient availability of bone. And, for dental implant to function healthily and esthetically, its proper placement in the oral cavity and restoration is an important procedure, for which remaining hard and soft tissue must be adequately present. To preserve bone at the future implant site socket preservation techniques have been employed, also known as socket seal surgery (SSS), which involve the placement of different bone graft materials in the socket.[3,4] The literature also confirms that early bone loss can be significantly reduced with socket grafting.[5,6] There are various graft materials which have been successfully used for the same purpose, however, calcium phosphosilicate putty (Novabone Dental Putty) has shown satisfactory and superior results as compared to other bone grafts.[7]

Novabone® (NB) is an alloplastic bone graft material. It is a third generation bioactive glass derived graft substitute in a putty format: Premixed composite of calcium phosphosilicate particulate and a synthetic absorbable binder in a putty form. It consists of 45% silica dioxide, 45% sodium oxide, 5% calcium and 5% phosphate. The bioactivity begins when they are mixed with saline or blood.[8] Silicon-oxygen bonds are broken to release silicic acid, which condenses to form a negatively charged gel at the surface of the particles. This gel serves to hold the glass particles in a cohesive mass.[9] This helps easy manipulation during insetting and prevents migration. This graft material has the ability to adhere to normal bone, which helps in its remodeling as well as enables hemostasis.[10]

Novabone®induces release of chemicals in the form of ionic dissolution products, or growth factors, such as bone morphogenetic protein (BMP), at controlled rates, by diffusion or network breakdown that activates the cells in contact with the stimuli.[11] The cells produce additional growth factors that in turn stimulate multiple generations of growing cells to self-assemble into the tissues *in situ* along the biochemical and biomechanical gradients that are present.[11] It also activates several families of gene, such as CD44, IGF2, MMP2, 60S ribosomal protein L6.[12] It has been successfully used in various osseous defects with no reported adverse events and with a good patient acceptability.

Depicting a typical case of socket preservation and implant placement (Figs 1 to 8). Preoperative image of 47 in a 45-year-old male marked for extraction (see Fig. 1). Figure 2 shows the extraction socket being filled with Novabone Putty. Figure 3 shows a collagen plug being placed to contain the graft material crestally. Figure 4 shows cross sutures with 4-0 cytoplast to stabilize the collagen plug. Figure 5 shows the radiographic view of the socket immediately postextraction. Figure 6 shows the radiographic view of socket filled with Novabone Putty. Figure 7 is the radiograph of the loaded implant at 1 year recall, while Figure 8 is a clinical image of the same. Figure 9 shows a histological decalcified section of a trephine core biopsy obtained at the time of implant placement, showing mature bone with evidence of remodeling.

Fig. 1: Preoperative picture of 47

Fig. 4: Suturing done with cytoplast

Fig. 2: Socket grafting with Novabone® putty

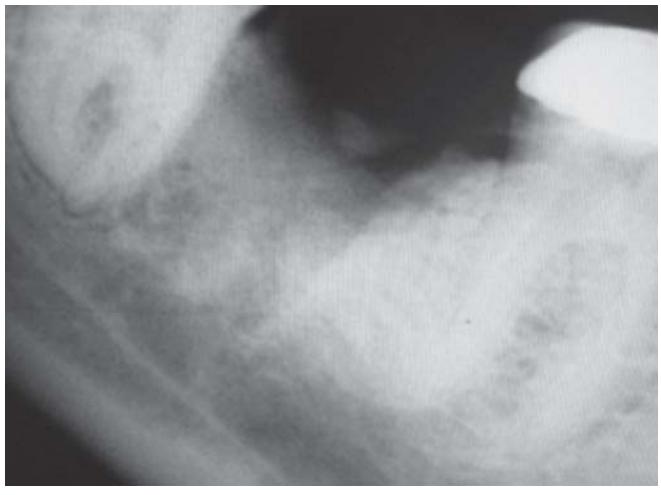

Fig. 5: After extraction

Fig. 3: Collagen dressing placed on the socket

Fig. 6: After socket augmentation with CPS putty

DISCUSSION

Socket preservation is a favorable treatment modality which enables the socket to heal without loss of bone and change in the ridge dimension. This helps in preserving the ridge, bony contours and soft tissues for implant placement. Also second surgery for reestablishment of lost alveolar ridge is not required saving time. Sometimes extensive surgical procedures are required to gain ridge's height and width for implant placement, this procedure eliminates of such extensive surgical procedures.

There are various graft materials used for socket preservation such as autografts, allografts and xenografts, all of these materials show varying degree of success.

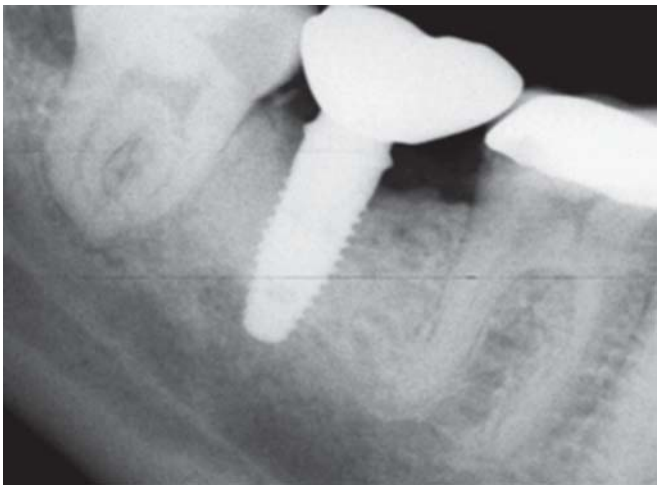

Fig. 7: Implant and crown in place

Fig. 8: Occlusal view of 47 after crown 1 year postoperative placement

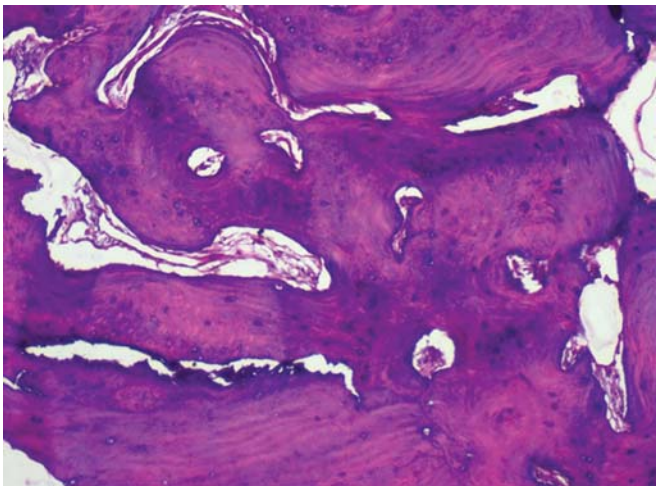

Fig. 9: Histology of bone at 4 months demonstrating mature bone with remodeling lines

Allografts have been successfully used for intraosseous defects, most common being DFDBA (Decalcified freeze dried bone allograft) however, controversy exists with respect to the osteoinductive potential of these materials.[13] It has been shown that inductive capacity varies from bone bank to bone bank and also from different batches of the same bone bank. The bioactivity is also dependent on the age of the donor, the younger the donor, the more osteoinductive graft material will be.[13,14] Also, there are chances of disease transmission. Due to these limitations use of alloplastic alternatives has been encouraged.

Novabone® is one such alloplastic bone graft material which has shows superior properties and better results. It is an osteoconductive and osteostimulative bioactive graft material which is premixed putty dispensed in syringes and cartridges. Its unique consistency and delivery system allows the clinician to fill large defects by injecting the putty directly into the defects, eliminating the need for handling the graft substitute.[15] The paste consistency allows uniform surface contact with the bony walls of the defect and eliminates the dilemma of over or under condensation of the graft material.[15] This graft material also provides adequate retention in the defect even during irrigation and suction.[15] NB stimulates the genes that control osteoblast differentiation and proliferation.[7] According to Pietrokovski,[16] dense trabecular bone is formed in extraction sockets. On radiographs, same results are seen with NB which shows same pattern of bone formation as seen in humans along with a high degree of neovascularization within the grafted area,[17] which is crucial for the support of new bone formation. The multi-staged mechanisms and kinetics of surface reactions of CPS putty demonstrate that these reactions take place within a short, 2 to 4 day time frame,[18] with attachment of stem cells and the subsequent proliferation and differentiation of osteoblasts rapidly occurring on the surface of the bioactive material. Waltimo et al[19] showed that NB also contains antibacterial properties.

In a histologic study, Froumet et al[20] compared bioactive glass and demineralized freeze-dried bone allograft (DFDBA) in extraction sockets and treated sockets observed more vital bone (59.5%) in bioactive glass grafted socket at 6 to 8 months postextraction than DFDBA treated sockets (34.7%). Moreover, the amount of residual implanted material (RIM) was higher with DFDBA (13.5%) than with bioactive glass treated (5.5%) sockets. In another study by Saroff[21] NB was radiographically and histologically examined in extraction socket after 5 months. Radiographic evidence indicated that the bone was healthy and had completely regenerated in the socket. Histologic section contained several fragments of dense vital bone along with thin fragments of osseous tissue and fresh hemorrhagic debris. Dimaira[22] in a clinical study of immediate grafting prior to implant placement showed immediate postoperative radiograph showed excellent adaptation of NovaBone Dental Putty to the implant surface. Six-week postoperative

radiograph revealed good trabecular pattern around the implant indicative of osseous regeneration and the nine-month postoperative radiograph showed excellent trabecular pattern indicative of complete resorption of the putty and successful bone regeneration. The radiographic analysis of the present study corresponds with the results of above written clinical studies.

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