Sinus Floor Augmentation with ß-Tricalcium Phosphate (R.T.R. Septodont)

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Resorption of the alveolar process and pneumatization of sinus in the edentulous posterior maxilla are a clinical challenge in the restorative/prosthetic treatment with dental implants. Diverse surgical procedures, bone grafts and substitutes have been used to repair that clinical situations. Reports have shown radiographic, histomorphometric and clinical significant results with ß-Tricalcium Phosphate. Two clinical cases of sinus floor augmentation with ß-Tricalcium Phosphate (R.T.R. Septodont) or the subsequent insertion of dental implant are presented in this report.

History

Resorption of the alveolar process and the pneumatization of the sinus in the posterior edentulous maxilla often represents a clinical challenge in restorative/prosthetic treatment with dental implants (1).
Al-Nawas and Schiegnitz (2014), continuing the work of Klein (3), have proposed a classification of augmentation procedures in which graft materials are used for bone formation in therapy with dental implants:
1) Maxillary sinus floor augmentation, including the lateral window technique and transalveolar approach and, 2) vertical and/or lateral alveolar ridge augmentation, including dehiscence-type and/or fenestration-type defect around the implant (2).
The biological and physiological properties of the bone grafts and bone substitute materials (BSM) have been described in terms of osteoinductivity, osteoconductivity and osteogenicity. Osteoconductivity can be described in terms of a biocompatible scaffold, resorbable at different speeds and time, in which the material reacts without consequences with the tissues at the receptor site. The three-dimensional structure of the material mostly facilitates vascular proliferation and, soon after, colonization and growth of osteoprogenitor and osteogenic cells. The physical and chemical properties influence bone formation to a lesser degree (4).

Tricalcium Phosphate

With a composition and crystallinity similar to the mineral phase of bone, Tricalcium Phosphate ($Ca_3(PO_4)_2$) is a biocompatible and bioresorbable material. Biodegradation of the material occurs in two ways: dissolution and osteoclastic resorption (5). Animal models have shown the resorption of beta-TCP, its replacement by bone and formation of bone marrow (6). Particle size, microporosity and speed of resorption confer its osteoconductive properties and promote the bone formation process (7, 8). Placed directly in cancellous bone, it retains its osteoconductive properties, and no tissue or systemic reactions were reported (9). Osteoconductive properties have been reported at ectopic sites (10). For decades, it has been used in Orthopaedics and multiple dental applications (11-14).

Procedure for maxillary sinus floor elevation

Two authors developed the surgical technique to augment bone height from the base of the maxillary floor (15, 16). Various modifications have been reported in the literature, but retaining the initial proposal: increasing the vertical dimension from the maxillary sinus floor with the use of graft and/or bone substitute materials placed between detached epithelial membrane and the denuded bone (17, 18, 24). The use of bone substitute materials has been reported in maxillary sinus floor augmentation procedures (19), including beta-tricalcium phosphate (20-22), with histomorphometric analysis (23) and simplified techniques (24). Trombelli et al. (2014) report the results of transcrestal maxillary sinus floor elevation done with a minimally invasive procedure and combined with the additional use of deproteinized bovine bone mineral or beta-tricalcium phosphate. (24) The survival of dental implants in maxillary sinus floor augmentation procedures with ß-tricalcium phosphate has been reported. (1) The authors report an increase in bone quantity associated with a decrease in grafted material and the presence of osteoclasts around the remaining particles of material. No complications or loss of implants were reported at 12 months.

Case Report no.1

Female patient, 56 years of age

Fig. 1: Edentulous area, first quadrant. Absence of premolars and molars lost 12 years ago. Replaced with removable partial denture.

Fig. 2: Occlusal view, quadrant 1.

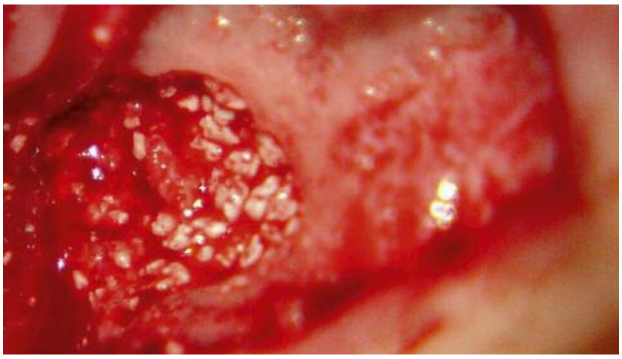

Fig. 3: Maxillary sinus floor augmentation procedure with lateral approach and ß-Tricalcium Phosphate "R.T.R." Septodont with bone graft substitute material (day 0).

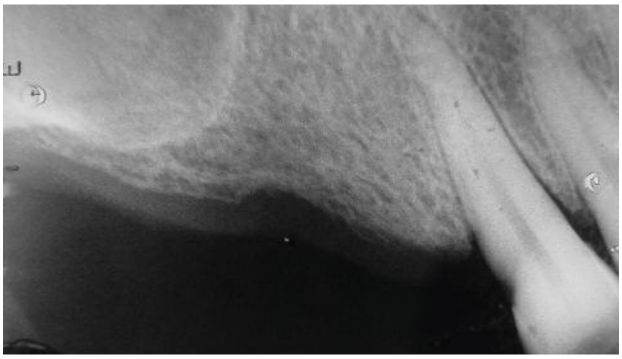

Fig. 4: Pre-op X-ray (day 0).

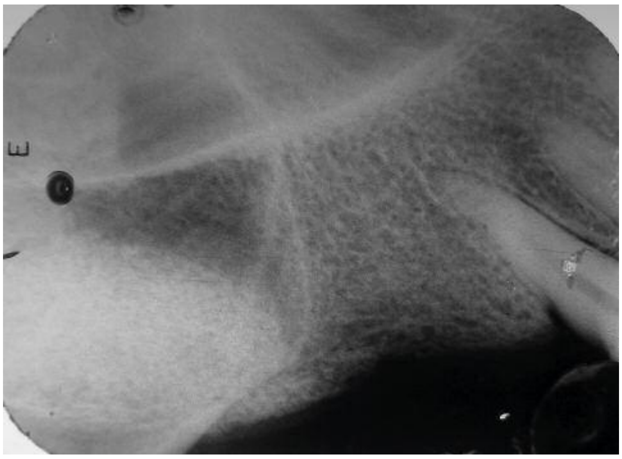

Fig. 5: X-ray immediately post-op showing the location of the ß-Tricalcium Phosphate on the maxillary sinus floor -radiolucent area- (day 0).

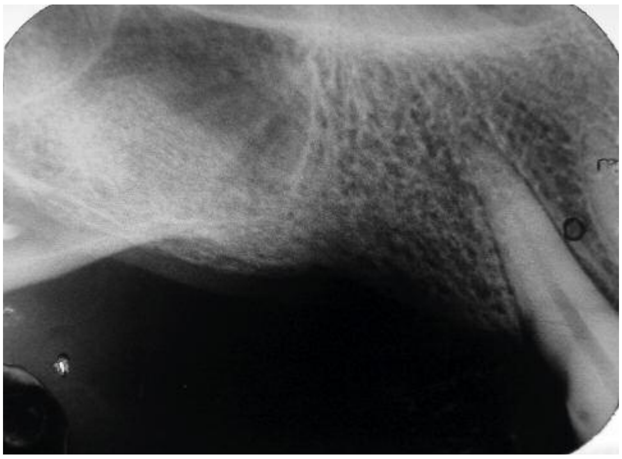

Fig. 6: X-ray six months after the maxillary sinus floor augmentation procedure with lateral approach and ß-Tricalcium Phosphate "R.T.R." Septodont as bone graft substitute material. The decrease in the radiolucent area shown in Fig. 6 is obvious, indicating the replacement of the material with new bone.

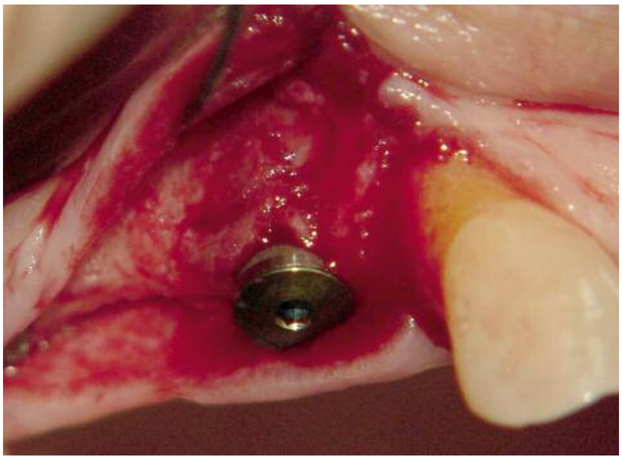

Fig. 7: During the surgical procedure (at 7 months) of implant placement, at the site of 14, the presence of the vestibular cortical plate of inadequate thickness is noted.

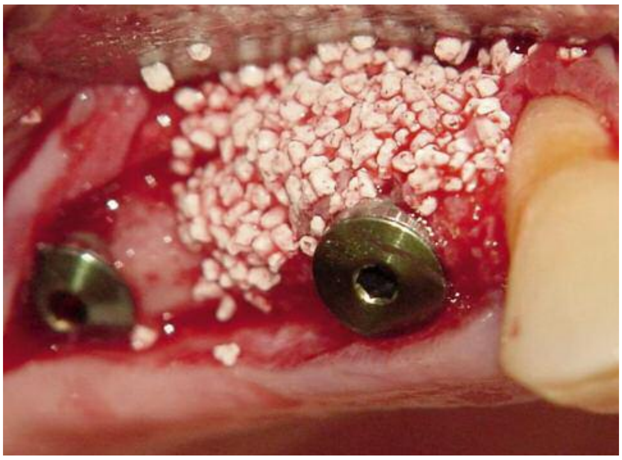

Fig. 8: ß-Tricalcium Phosphate "R.T.R." Septodont as bone graft substitute material in the vestibular plate of 14. Distal implant in the first molar area placed in the area of the maxillary sinus floor augmented 7 months earlier.

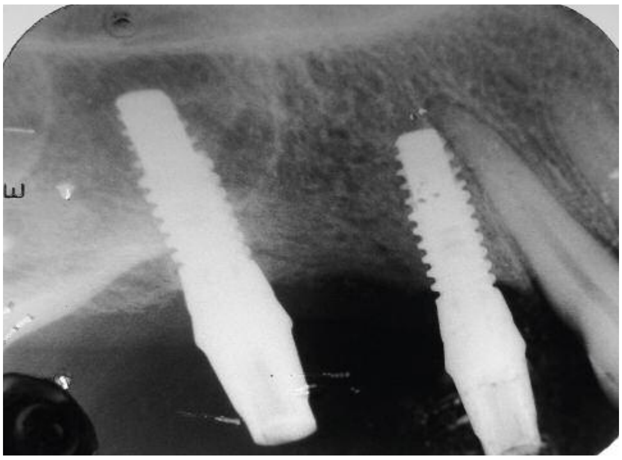

Fig. 9: X-ray immediately after placement of the prosthetic pillars on the implants. Stability of the implant in the area of 16 was clinically proven.

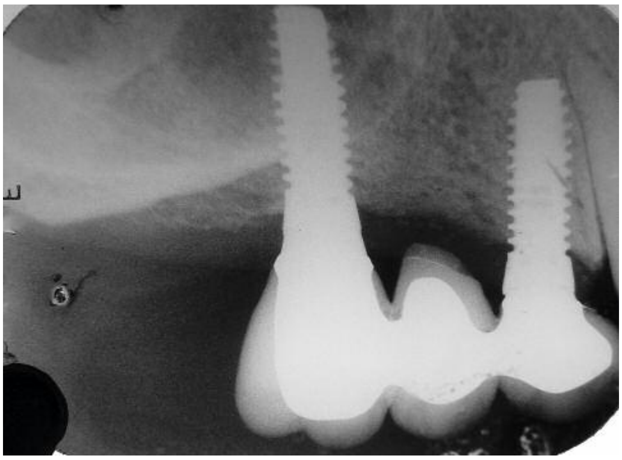

Fig. 10: Prosthetic restoration 10 months after the maxillary sinus floor augmentation procedure with lateral approach and ß-Tricalcium Phosphate "R.T.R." Septodont and 3 months after placement of the implants.

Case Report no.2

Female patient, 55 years of age

Fig. 1: Left atrophic posterior maxilla. Absence of molars lost approx. 10 years ago. Replaced with removable partial denture.

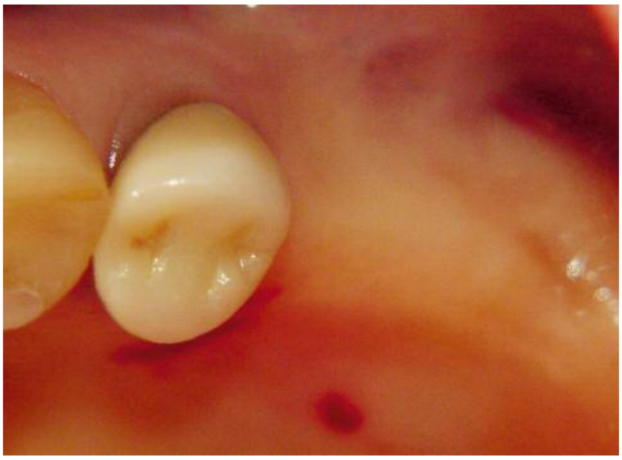

Fig. 2: Occlusal view of the area.

Fig. 3: Pre-op X-ray.

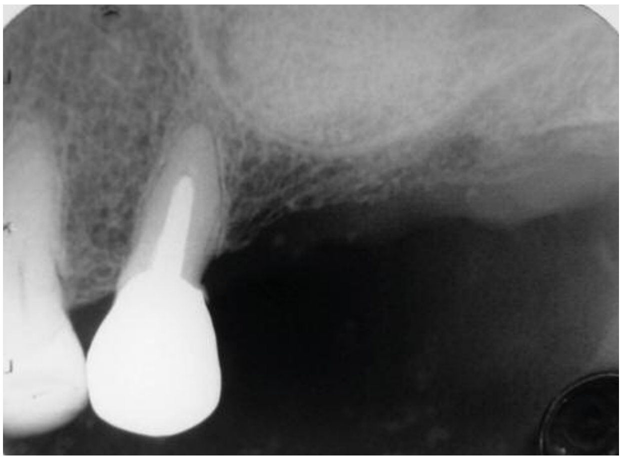

Fig. 4: X-ray immediately post-op showing the placement of the ß-Tricalcium Phosphate on the maxillary sinus floor -radiolucent area- (day 0).

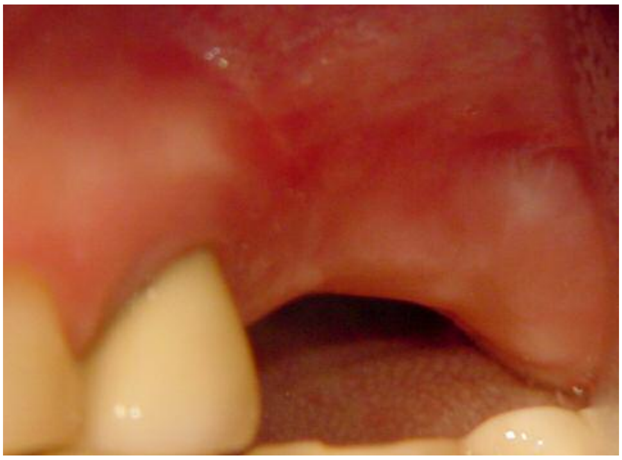

Fig. 5: Pre-op clinical image 6 months after ß-Tricalcium Phosphate graft "R.T.R." Septodont.

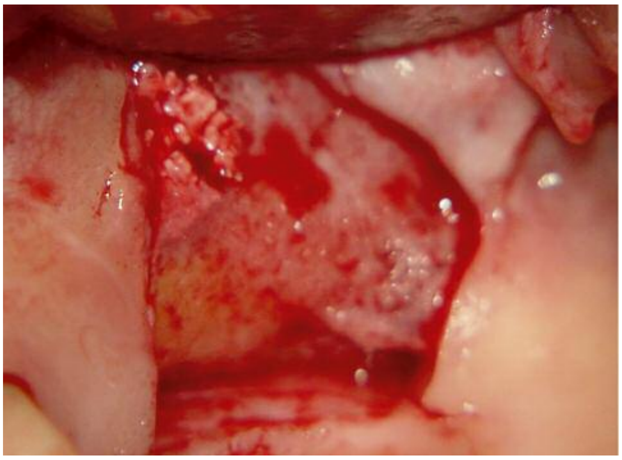

Fig. 6: In the window of the sinus lift procedure done 6 months earlier, granules of ß-Tricalcium Phosphate "R.T.R." Septodont are observed, which indicates partial replacement with new bone.

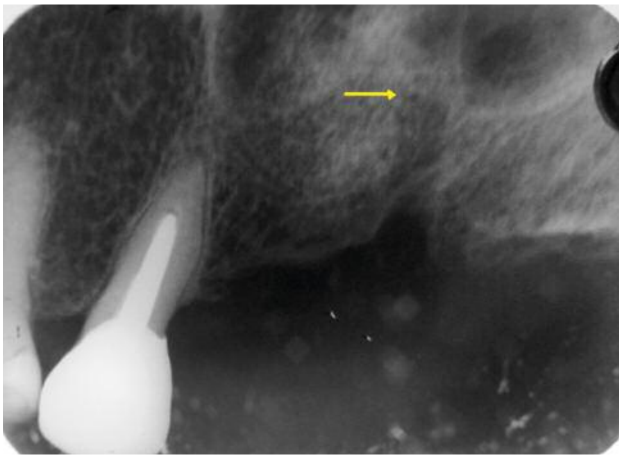

Fig. 7: X-ray image to confirm the cutting depth (2.5 mmØ) of the implant receptor site at 10 mm (arrow). Partial replacement of the bone substitute material with receptor bone is obvious.

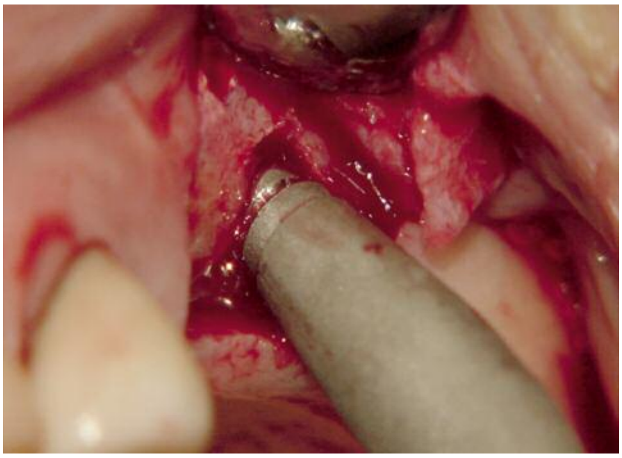

Fig. 8: With osteotomes (Summers technique, 1994) the maxillary sinus floor is lifted 2 mm to achieve insertion of a 12-mm long implant.

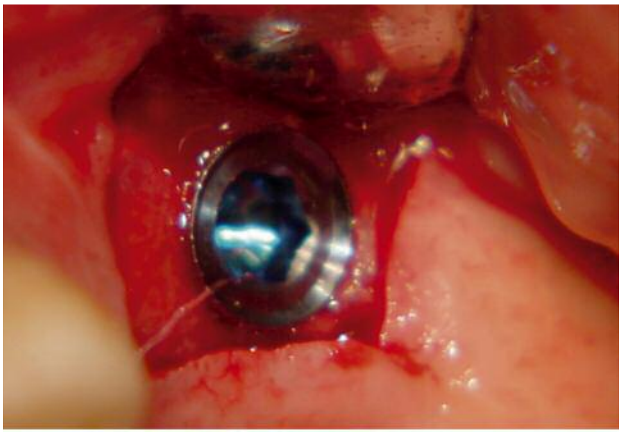

Fig. 9: Implant 12 mm long by 5 mm diameter placed at bone crest level.

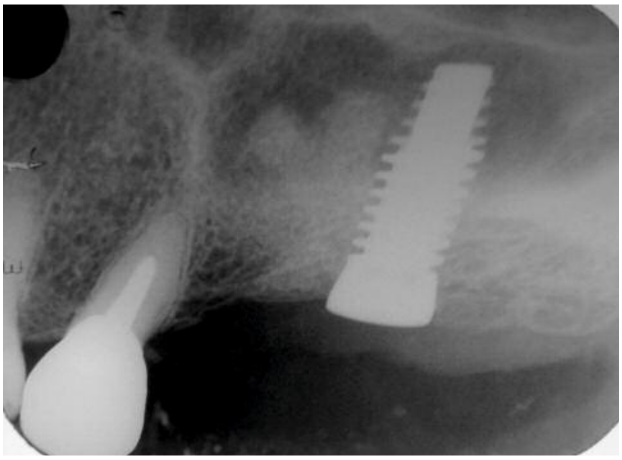

Fig. 10: X-ray image showing the placement of the implant.

Conclusions

Resorption of the alveolar process and pneumatization of the sinus in the edentulous posterior maxilla often represents a clinical challenge in restorative/prosthetic treatment with dental implants (1). Various surgical procedures and graft materials have been used to correct such changes (20-22), including ß-Tricalcium Phosphate (23). Miyamoto et al. report "… particles of tricalcium phosphate attract osteoprogenitor cells that migrate into the interconnected micropores of the bone substitute material by six months" (25). The stability of the implants placed at the sites has been evaluated (24). A recent systematic review concludes: "There is a high level of evidence that survival rates of dental implants placed into augmented areas are comparable with survival rates of implants placed in pristine bone. For maxillary sinus floor elevation, all investigated bone substitute materials performed equally well compared with bone, with high dental implant survival rates and adequate histomorphometric data" (3). The two cases presented show satisfactory results in the use of the bone graft material, ß-Tricalcium phosphate "R.T.R." Septodont based on the evidence reported. This, along with the availability of the material and its safety in use, make it a therapeutic choice with multiple benefits.

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