CLINICAL CASE REPORT

Histological Regeneration Effectiveness of Biphasic Calcium Sulfate Bone Cement After Baranes-Yahav Sinus Lift Technique: A Clinical Case Series

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Sinus floor elevation remains a fundamental regenerative procedure for implant placement in the posterior maxilla, particularly in cases of vertical bone deficiency or a steeply inclined sinus floor. Although the lateral window approach has traditionally been favored for its visualization and membrane control, it is more invasive and often associated with greater morbidity. Minimally invasive crestal sinus elevation techniques have gained prominence as an alternative though challenges remain regarding membrane safety and predictability. Bond Apatite (Augma), a hardening biphasic calcium sulfate–hydroxyapatite cement, offers physical and biologic characteristics well suited to the crestal approach, especially when paired with the Baranes-Yahav technique. This case series evaluates histologic outcomes of crestal sinus augmentation performed with the Augma Lift technique using Bond Apatite. Eleven specimens obtained at 4, 6, and 8 months postaugmentation were analyzed with standard hematoxylin and eosin staining and immunohistochemistry. All samples showed progressive new bone formation with controlled resorption of the calcium sulfate component and long-term integration of hydroxyapatite crystals. By 8 months, the regenerated bone averaged 82.4% and exhibited excellent vascularity and structural maturity, allowing implant placement with primary stability exceeding 25 Ncm. No inflammatory reactions or adverse tissue responses were observed. The findings demonstrate that Bond Apatite supports predictable osteoconduction and stable space maintenance during minimally invasive crestal sinus augmentation. When combined with the Baranes-Yahav technique, the material offers a safe, efficient, and clinically effective alternative to traditional lateral window procedures, consistent with current trends toward less invasive regenerative implant dentistry.

Key Words: Bond Apatite, Augma, crestal sinus elevation, Baranes-Yahav technique, maxillary sinus lift, regenerative cement, calcium sulfate, hydroxyapatite, posterior maxilla, dental implants, bone regeneration, minimally invasive sinus augmentation

INTRODUCTION

In preimplant regenerative surgery of the posterior maxilla, sinus floor elevation remains a cornerstone technique for addressing vertical bone deficiencies. When the alveolar ridge exhibits significant vertical atrophy or a steeply inclined sinus floor, introducing augmentation material between the Schneiderian membrane and the crestal bone becomes essential to achieve adequate bone height for implant placement.[1] Traditionally, sinus augmentation has been performed via the lateral window approach, which provides broad visualization and membrane control. However, despite its advantages, the lateral approach is more invasive, technique-sensitive, and often associated with increased morbidity.

Over the past decade, crestal access sinus elevation techniques have gained prominence as minimally invasive alternatives, offering reduced postoperative discomfort and a simplified surgical workflow.[2] Yet no approach guarantees complete visualization or eliminates the risk of iatrogenic membrane perforation. This has driven ongoing development of techniques and grafting materials that combine surgical simplicity with predictable regenerative outcomes.

Bond Apatite (Augma), a biphasic, hardening calcium sulfate–hydroxyapatite (HA) regenerative cement, has emerged as a material well suited to crestal sinus augmentation. Its rapid hardening, bacteriostatic properties, and ability to maintain space without requiring a membrane align well with minimally invasive sinus elevation procedures.[3,4] The Baranes-Yahav crestal sinus lift technique is one such approach in which the

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https://doi.org/10.1563/aaid-joi-D-26-00045

material's physical characteristics provide unique clinical advantages.

This article presents a case series evaluating histologic outcomes following crestal sinus augmentation performed using the Augma Lift (Baranes-Yahav) technique with Bond Apatite. The findings highlight the material's resorption kinetics, osteoconductive properties, and bone regeneration pattern and its ability to support stable new bone formation suitable for dental implant placement.

Baranes-Yahav Clinical Technique

The ASSEK (All Secure Sinus Elevation Kit; ASSEK Technical, Jerusalem, Israel, and Augma Lift & Augma Biomaterial Ltd, Caesaria, Israel) provides a controlled crestal approach for sinus floor elevation using diamond-coated milling drills designed to minimize Schneiderian membrane perforation:[5] the B.Y. (Kit A) (Figure 1a) and B.Y.S. (Kit B) (Figure 1b).

Drills feature a blunt, concave apical design (Figure 1c) that mills bone rather than cutting it, always creating a stable bony disc that remains attached to—and protects—the sinus membrane. As the drill reaches the sinus floor, the remaining plate of bone, which persists during detachment of the ridge floor and its advancement into the sinus cavity, proves that there is never direct contact with the sinus membrane during the osteotomy. Consequently, at this stage, membrane tearing is almost impossible when respecting the system protocols.

Elevation is achieved using straight or bayonet osteotomes, each with millimeter markings and depth stoppers. Their convex, nonaggressive tips advance the bony disc in 1-mm increments, allowing a controlled 5-mm membrane lift while respecting physiologic elasticity. A slight bleeding halo confirms membrane integrity. After elevation, the space is grafted with the Bond Apatite, a nonaggressive material. In this study, Bond Apatite (Augma Biomaterials) was selected for its advantages, including gradual resorption and transformation to achieve true bone regeneration and its ability to act as its own barrier.

The ASSEK/Augma Lift system enables sinus lift procedures even in extreme cases with a residual ridge height of 1 mm or more. In cases in which the ridge height is less than 4 mm, a 2-stage approach is required: the first stage involves ridge augmentation without implant placement. Following a 5-month healing period, once sufficient bone height is achieved, a second lift is performed with simultaneous implant insertion. Conversely, when the initial ridge height is 4 mm or more, the sinus lift can be completed in a single stage along with immediate implant placement.

The ASSEK/Augma Lift system includes 2 kits:

- Universal Kit A contains 10 diamond milling burs, ranging from 1 to 10 mm in length with a 4 mm diameter.
- Universal Kit B contains 6 diamond milling burs, ranging from 4 to 10 mm in length with a 2.8 mm diameter.

Each of the 2 kits includes a pair of specific osteotomes, a bone carrier syringe, and a dish (Figure 1).

When $<$4 mm of crestal bone is present, a fully delayed protocol is followed, using Kit A for initial elevation and grafting. A second stage can be performed at 5 months, using Kit A or Kit B, for a Summers-type approach and implant placement. When $>$4 mm of crestal bone is present at baseline, Kit A or Kit B alone enables sinus elevation, grafting, and implant placement in a single stage.

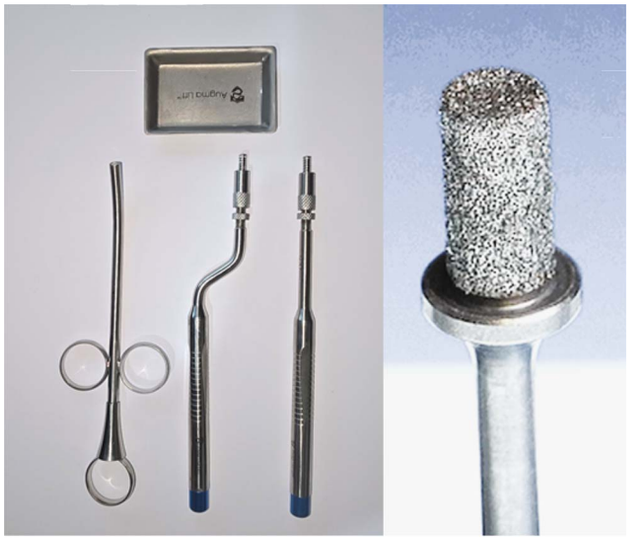

Figure 1. Application tools for Augma Lift/ASSEK technique (left) and the concave tip of the B.Y. drill (right).

When using Kit A in cases in which the ridge height exceeds 4 mm (allowing for immediate placement), the minimum implant diameter must be 5 mm. Conversely, when using Kit B, the system allows insertion of implants with diameters of 3.75 mm or 4.2 mm.

Refined Surgical Protocol: Augma Lift

Preoperative assessment

The procedure begins with a cone beam computerized tomography (CBCT) evaluation to rule out sinus pathologies and ensure the site is suitable for augmentation. Once cleared, a detailed assessment of the sinus anatomy, ridge morphology, and residual crestal height is performed.

The surgical protocol follows three crucial stages: milling, lifting, and filling.

Scenario A: Residual crest height $<$ 4 mm (delayed protocol) (Figure 2)

In cases with less than 4 mm of bone, a 2-phase approach is utilized:

- Milling stage: Following flap elevation, Kit A is used. Diamond milling burs are used in sequence (B.Y.1, B.Y.2, etc.) to create the osteotomy until the crestal floor is detached, resulting in a protective bony disc.
- Lifting stage: Manual osteotomes are used gradually to elevate the membrane. To minimize the risk of perforation, the membrane is elevated to a maximum of 5–6 mm.
- Filling stage: Bond Apatite is placed incrementally and compacted using stopped osteotomes. To prevent excessive pressure

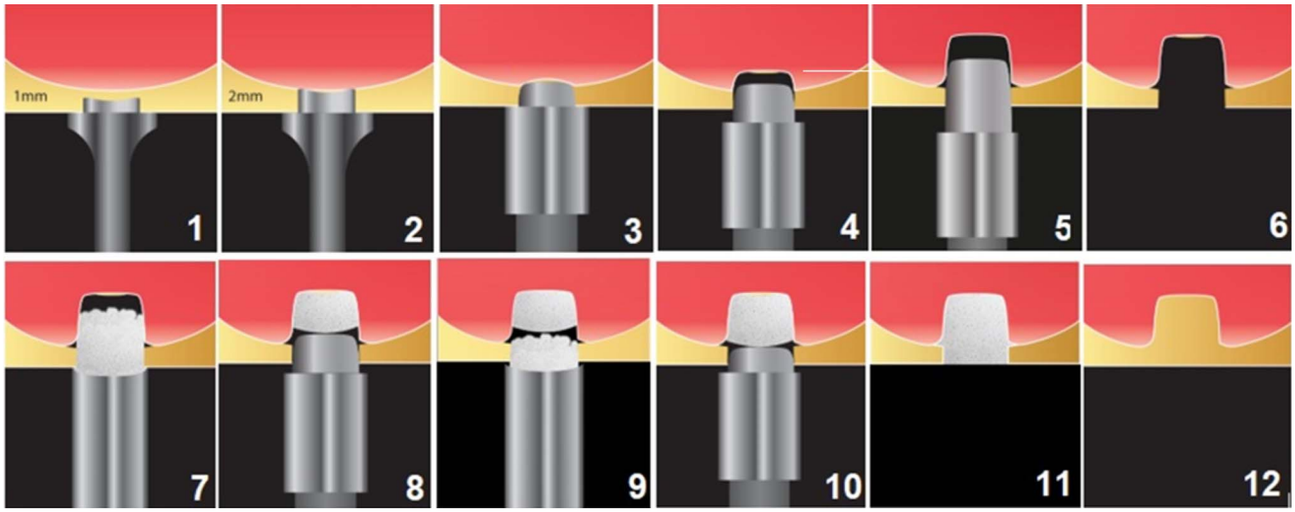

Figure 2. Clinical steps for scenario A utilizing Kit A.

on the sinus membrane, the osteotome length is reduced by 1 mm with each subsequent graft increment.

- Closure: The osteotomy is sealed with additional graft material. The flap is closed under compression, and an Augma Shield (external healing adhesive) is applied to protect soft tissue. A radiograph is taken to confirm the lift and graft position.

Scenario B: Phase 2 (at 5 months) or simultaneous placement (Figure 3)

After 5 months of healing or in cases in which the initial height allows for simultaneous placement:

- Bur selection: Based on the new CBCT evaluation, the corresponding B.Y. drills are selected according to the desired implant diameter (Kit A or B). The initial drill should be 2 mm shorter than the measured crestal height (eg, if the height is 6 mm, start with a B.Y. 4 mm bur).
- Detachment verification: After milling with each B.Y. bur until the stopper is reached, the next bur in the sequence is introduced without rotation.
  - If the bur reaches the stopper without rotation, the crest has been detached.
  - If it does not reach the stopper, the bur is activated, and milling continues until the stopper is reached. This check-then-mill process repeats until detachment is confirmed.

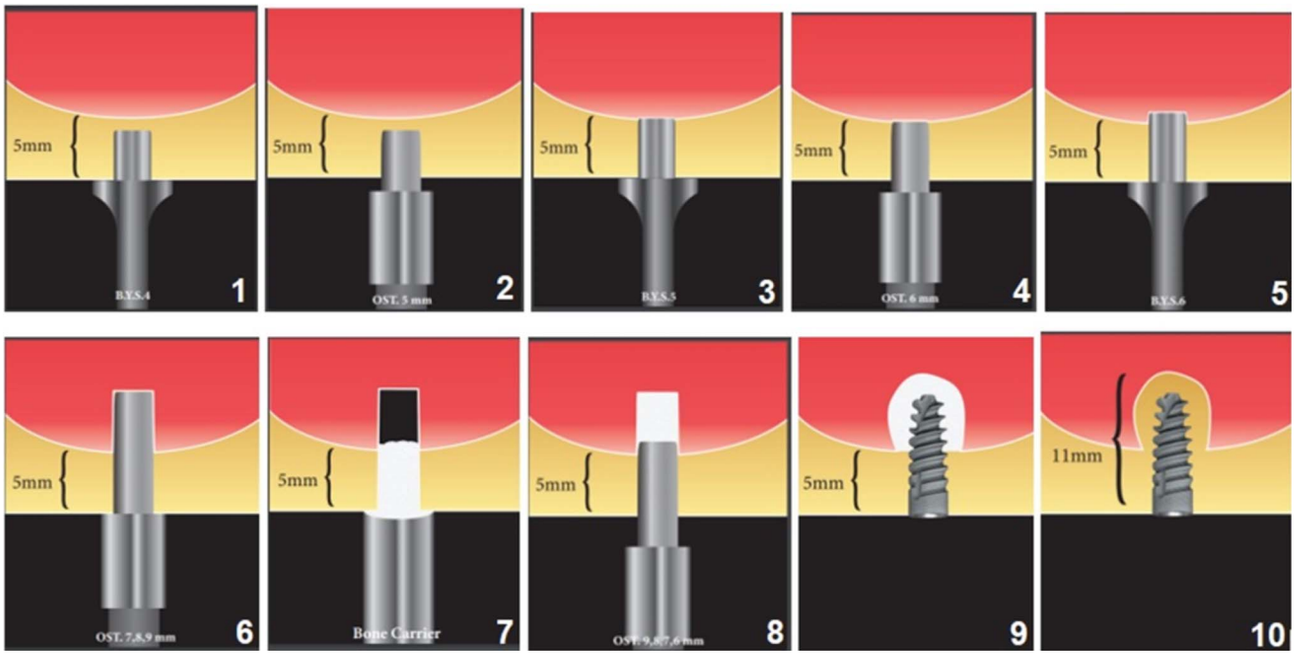

Figure 3. Clinical steps for scenario B can be performed using Kit A or Kit B.

- Elevation: Once detached, an osteotome 1 mm longer than the final B.Y. bur is used. The membrane is raised 1 mm at a time until an additional 5 mm of elevation is achieved.
- Graft preparation and filling: Bond Apatite is activated in the syringe and injected into a sterile dish. A dry sterile gauze is placed on top for 1–2 seconds with firm finger pressure to remove excess liquid. It is then reloaded into a bone carrier syringe and introduced into the osteotomy.
- Compaction and implant placement: With each graft increment, the osteotome length is reduced by 1 mm. Filling continues until the graft reaches a level 2 mm below the detachment point. At this stage, the implant is placed.
- Completion: Final crestal grafting is performed as needed around the implant before closure. A postoperative radiograph documents the new sinus floor and implant position.

Materials and Methods

Sinus floor elevation was performed via the Augma Lift crestal approach, following the Baranes-Yahav technique. Eleven samples were collected for histologic evaluation at 4, 6, and 8 months before implant placement. Specimens included 4 bone chips harvested with dedicated burs and 7 trephined bone cores (inner diameter 3.5 mm, length 12 mm).

The study group consisted of 11 healthy adult patients (6 female, 5 male) aged 29 to 65 years. Demographic data and graft healing intervals for each subject are summarized in the Table.

All specimens were immediately placed in 10% buffered formalin and transported to the pathology laboratory within 24 hours. Decalcification was performed using Shandon TBD-1 Rapid (14% hydrochloric acid). Block sections were then prepared using a bone microtome equipped with a Feather N-35 bone blade to obtain 5-μm sections. Standard hematoxylin (15 minutes) and eosin (50–52 seconds) staining protocols were applied.

In samples 9 and 10, focal areas exhibited a chondroid-appearing matrix. Immunohistochemical analysis for S-100 antigen confirmed that these areas represented HA crystal remnants rather than true cartilaginous transformation.

Results

All samples demonstrated clear evidence of new bone formation following the Augma Lift procedure. Bond Apatite's biphasic calcium sulfate (BCS) component was detectable histologically up to 8 months postoperatively, reflecting its controlled resorption profile; HA, as expected, persisted longer and was still identifiable in the 8-month samples, consistent with its role as a long-term osteoconductive scaffold.

A progressive, time-dependent transition was observed in all cases with osteoclast-mediated resorption of BCS and gradual integration of HA particles into the newly forming bone. Notably, histologic sections revealed a seamless interface between the residual HA crystals and the newly formed trabecular bone with active osteoblastic activity directly on particle surfaces, an indicator of favorable cellular compatibility.

Table

General characteristics of the study group

Quantity of Patients	n = 11
Age, y	29–65
Mean age, y	51.7
Weight, kg	57–79
Mean weight, kg	60.2
Sex F/M	6/5
Augma Lift via crestal approach	11
Samples bone chips/bone blocks	4/7
Histology after 4 months	2
Histology after 6 months	3
Histology after 8 months	6
Quantity of using graft, ml	12

The ossification process occurred along both fibrous connective tissue matrices and isolated cartilage-like substrates, neither of which impeded bone regeneration. Mean regenerated bone content at 8 months reached 82.4%, reflecting substantial maturation of the augmented site.

All sites exhibited excellent vascularity, confirmed clinically by bleeding of the trephined bone during implant osteotomy preparation. Implants placed into the regenerated bone demonstrated favorable primary stability, consistently exceeding 25 Ncm. No inflammatory changes or adverse reactions to the material were observed.

Histological case examples

Patients in the following case examples provided written consent to the treatment presented to histological examination of the core samples taken during the treatment sequence and to the use of CBCT and radiographs for inclusion in the article.

Case 1: A 54-year-old male presented with a missing maxillary first molar. Insufficient ridge height was presented, requiring crestal sinus augmentation to permit implant placement. A delayed approach would be followed, allowing graft healing before implant placement. The site was treated with the ASSEK Kit A and the surgical approach previously outlined. The sinus was elevated and the site filled with Bond Apatite, flap closed, and a radiograph taken (Figure 4, left). At 6 months postgrafting, a radiograph was taken in preparation for implant placement (Figure 4, middle). The site was flapped, a core sample was taken with a trephine drill, then the osteotomy was created, and a 4.5 × 5.0 mm Bicon implant was placed. A healing abutment was placed and a final radiograph taken (Figure 4, right). The core sample was sent for histological analysis. The histological report noted the presence of new bone, old hypercalcified bone, and small crystals of BCS (Figure 5). The circled area demonstrated slow resorption of BCS crystals and new bone formation without inflammation.

Case 2: A 57-year-old female was planned for treatment for implants in the edentulous posterior left maxillary quadrant that would require sinus elevation to provide adequate ridge height for implant placement. Sufficient height was available for simultaneous implant placement at the premolar site due to the available ridge height but not at the molar site.

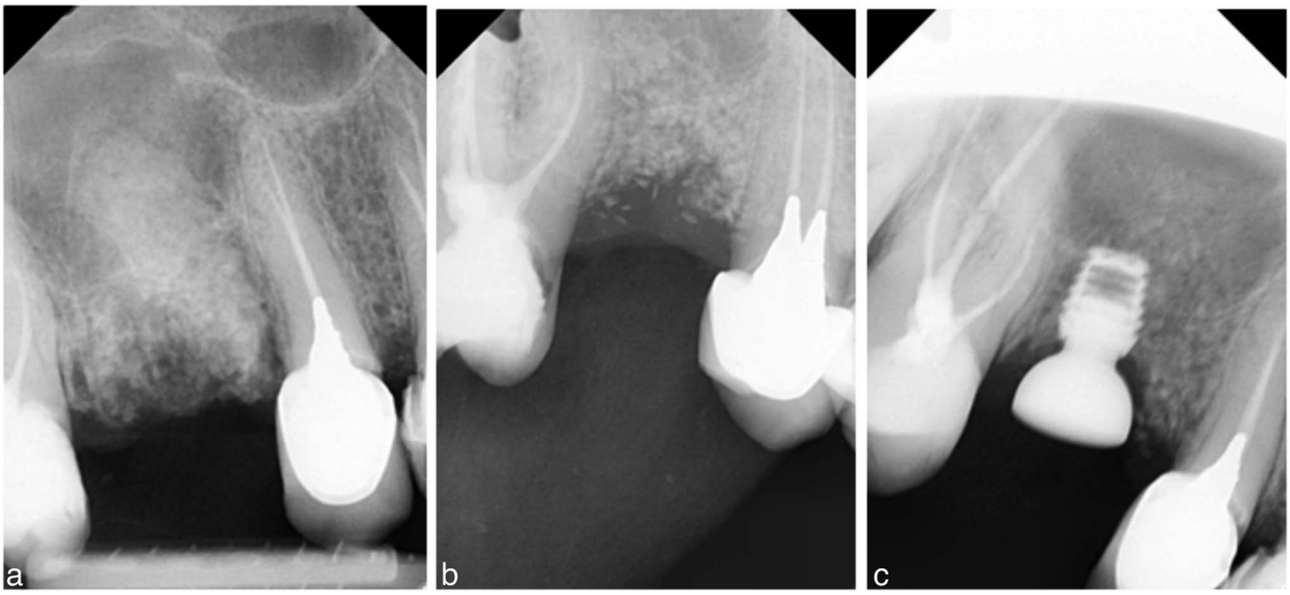

Figure 4. Extraction site following socket grafting (a), site post grafting at 6 months (b), and following implant placement (c).

Site preparation was performed using Kit B for the premolar site, and a 4.2 × 11.5 mm Noris Tuff implant (Noris Implant Systems, Nesher, Israel) was placed. The molar site was prepared with Kit A, and Bond Apatite was placed. A radiograph was taken to document the sinus elevation and implant placement (Figure 6, left). At 6 months post sinus elevation, the patient presented for implant placement at the molar site. The site was flapped, a core sample was taken with a trephine drill, the osteotomy was created, a 5.0 × 10 mm Noris Tuff implant was placed, and a radiograph was taken (Figure 6, right). Histological analysis noted the presence of new bone and small crystals of BCS with no inflammation in the sample (Figure 7).

Case 3: A 65-year-old female was planned for implant placement in the posterior maxillary left quadrant to replace the missing second premolar and first molar. Inadequate ridge height necessitated sinus elevation, and due to insufficient present available ridge height, a delayed approach was required. The protocol using Kit A was followed by Bond Apatite placed in the elevated sinus. The patient returned at 8 months, the site flapped, and a core sample was taken for histological analysis. Osteotomies were created, and Bicon implants (Bicon Implants, Boston, Mass) were placed at the second premolar (4.5 × 6.0 mm) and at the first molar (5.0 × 5.0 mm). A radiograph was taken 1 week post implant placement (Figure 8). New bone, connective tissue, and HA scaffold were noted histologically with the scaffold of HA crystal (circle) (Figure 9, left). At higher magnification, on the surface of the HA crystal, slow resorption and a smooth transition between crystal structure and new bone without any inflammation was noted (Figure 9, right The HA is slowly resorbed by osteoclasts with new bone growing inside the scaffold.

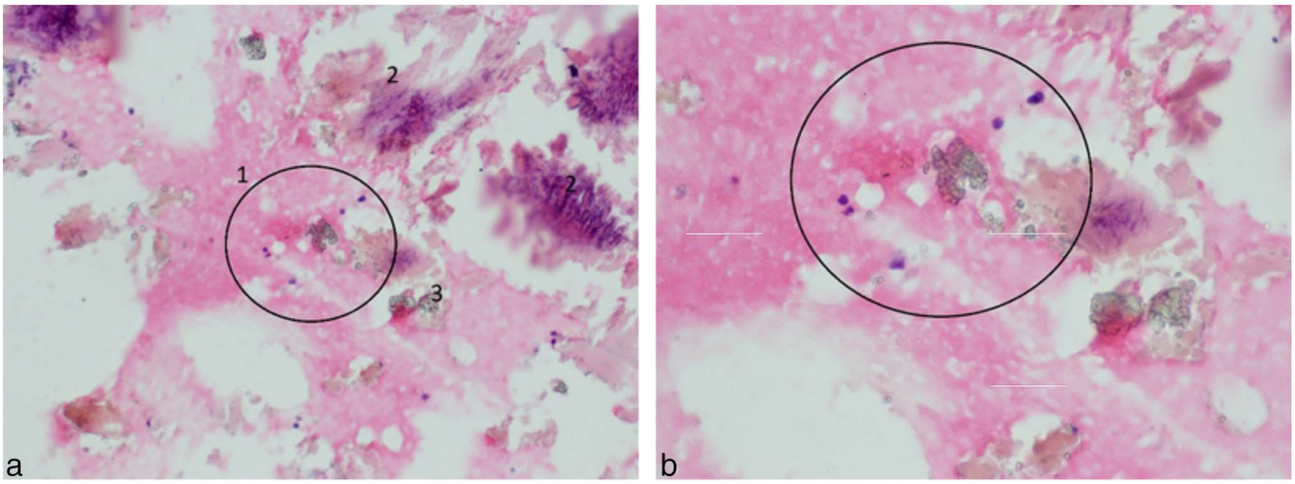

Figure 5. New bone (1), old hypercalcified bone (2), and small crystals of biphasic calcium sulfate (BCS) (3) were noted at ×100 (a) and ×200 (b). Within the circled area, BCS crystal slow resorption and new bone formation without inflammation were noted.

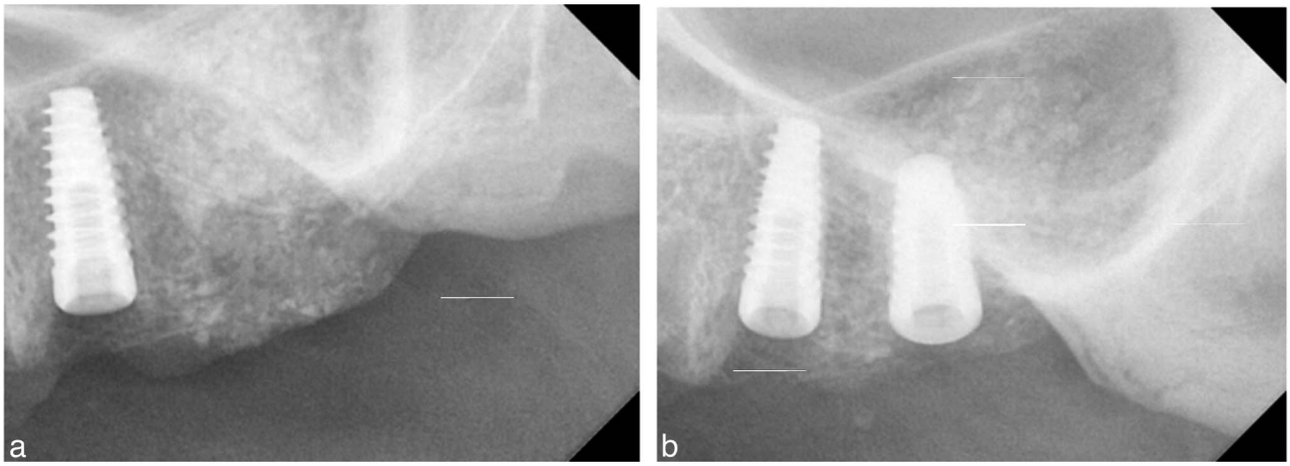

Figure 6. Radiograph following premolar implant placement and sinus augmentation (a) and at implant placement at the molar site 6 months later (b).

Case 4: A 42-year-old male was planned for an implant at the missing maxillary second premolar, which would require sinus elevation. Due to the height of the available ridge, a delayed implant placement approach was indicated. The protocol utilizing Kit A was followed, and Bond Apatite was placed into the elevated sinus at the site. At 4 months post sinus elevation, a radiograph was obtained before implant placement (Figure 10, left). The site was flapped and a core sample taken with a trephine drill for histological analysis. The osteotomy was completed, and a 5.0 × 10 mm Noris Tuff implant was placed. A CBCT was taken, and when viewed in cross-section, the gain in ridge height to accommodate the implant was evident (Figure 10, right). Histological analysis noted new growing bone, small crystals of BCS, BCS crystals surrounded by osteoclasts with slow resorption, and new bone with minimal inflammation (Figure 11).

Case 5: A 57-year-old male was treated with the placement of an implant in the left second molar position to allow connection to a previously restored implant at the first premolar site for a bridge to replace the missing second premolar and molars. Enlargement of the maxillary sinus would necessitate sinus elevation to allow implant placement. Minimal ridge height was present, so sinus elevation following Kit A was performed, followed by Bond Apatite placement. The patient presented 8 months post sinus elevation, and a radiograph was

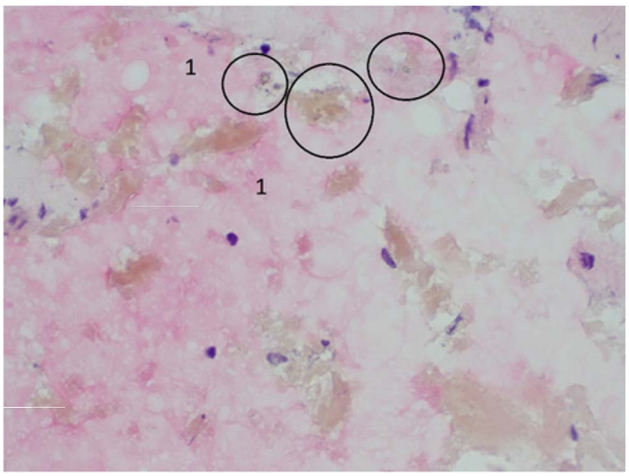

Figure 7. Histological analysis shows new bone (1), small crystals of biphasic calcium sulfate (2), and a lack of inflammation.

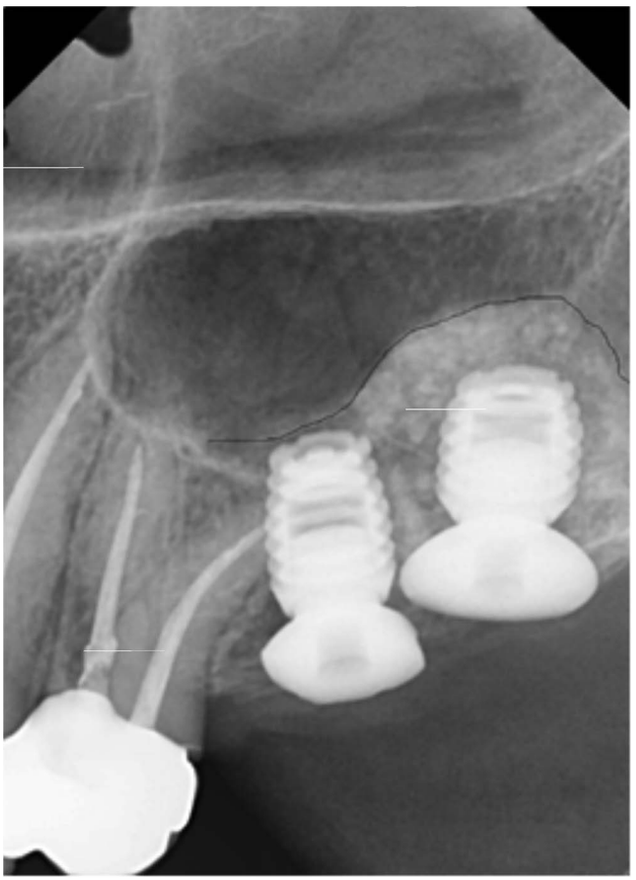

Figure 8. Radiograph 8 months post sinus elevation, 1 week post implant placement.

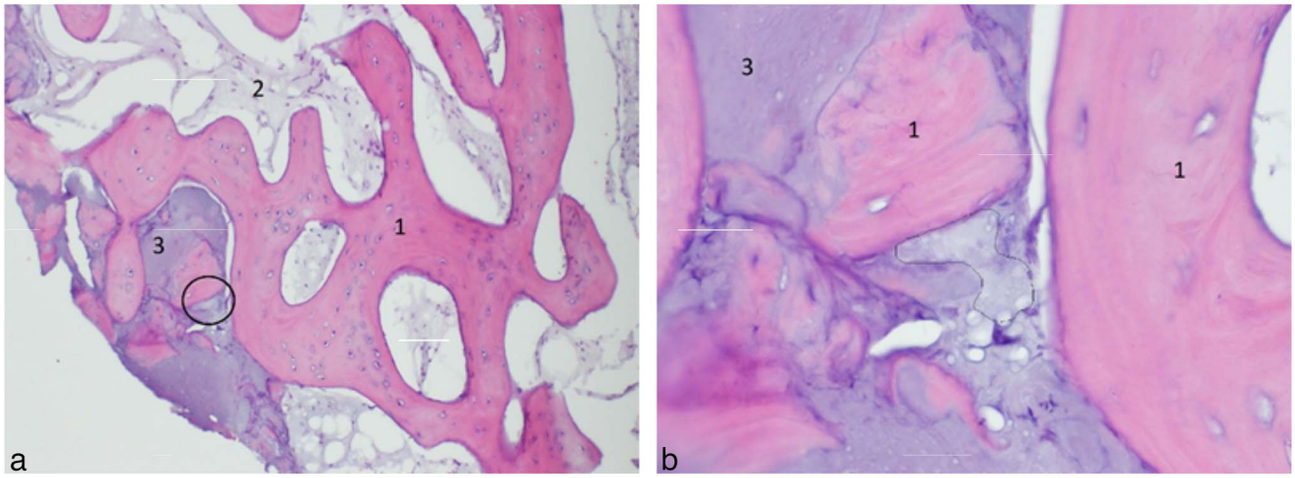

Figure 9. At ×200 (a) and ×400 (b), new bone (1), connective tissue (2), and hydroxyapatite (HA) scaffold (3) are noted histologically with the scaffold of HA crystal (circle), and at higher magnification (b) on the surface of the HA crystal, slow resorption and a smooth transition between crystal structure and new bone without any inflammation was noted.

obtained, demonstrating organization of the grafted site (Figure 12, left). The site was flapped, and a core sample was taken, followed by osteotomy preparation and placement of a 5.0 × 11.5 mm iRES implant (iRES Implants, Lugano, Switzerland). A cover screw was placed, and the site was closed. A radiograph was taken to document implant placement (Figure 12, right). Histological analysis noted the presence of new bone, an HA crystal scaffold, and bone marrow (Figure 13). On the surface of HA crystals, slow resorption and a smooth transition between the crystal structure and new bone without any inflammation were evident (Figure 14). The scaffold is slowly resorbed, maintaining its volume so new bone can grow on it.

Case 6: A 30-year-old female presented with the maxillary left first molar missing that had been previously extracted. Minimal ridge height was present, and the treatment plan consisted of sinus elevation and delayed implant placement following graft healing. The Kit A protocol was followed, the sinus was elevated, and the site was filled with Bond Apatite. At 8 months post sinus elevation, the patient presented; the site was flapped, and a core sample was taken. The osteotomy was completed, and a 5.0 × 10 mm Noris Tuff implant was placed. A cover screw was placed, and the flap was closed. A CBCT was taken, and the cross-section demonstrated the elevation achieved in relation to the initial sinus floor position (Figure 15). Histological analysis noted at ×100 (Figure 16), ×200 (Figure 17), and ×400 (Figure 18) new bone, HA crystals, and connective tissue. On the surface of the HA crystals, slow resorption and smooth transition were noted between the crystal structure, chondroid tissue, and new bone without any inflammation evident.

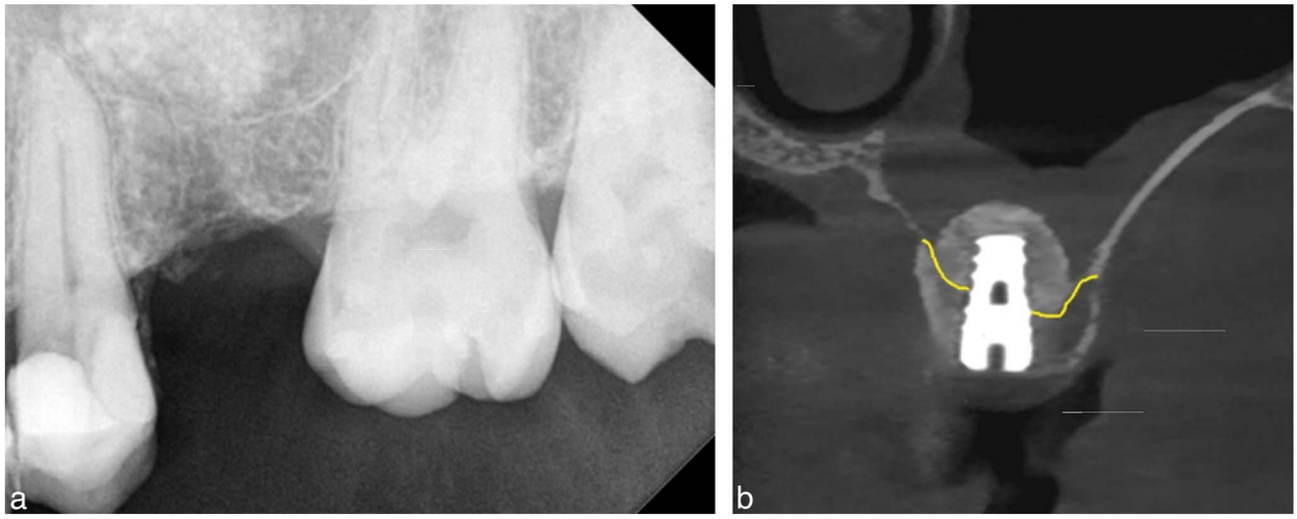

Figure 10. Radiograph at 4 months post sinus elevation (a) and cone beam computerized tomography cross-section following implant placement (b) (yellow line indicating pretreatment sinus floor position).

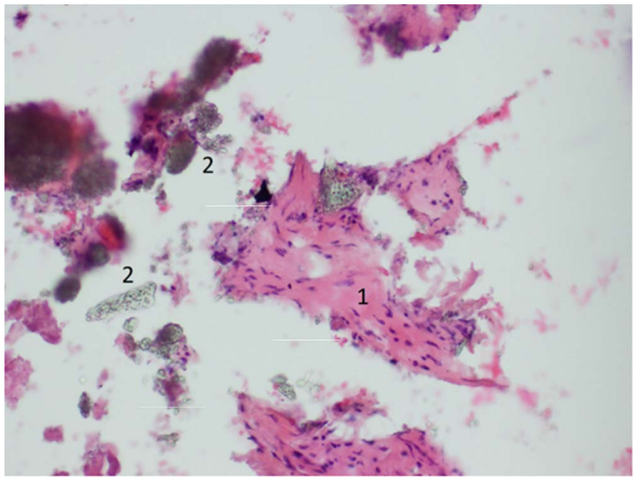

Figure 11. Histologically, new growing bone (1) and small crystals of biphasic calcium sulfate (BCS) (2) were noted with crystals of BCS crystal surrounded by osteoclasts.

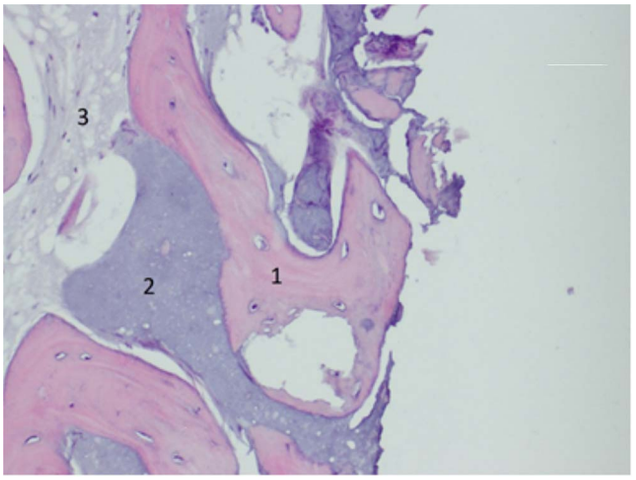

Figure 13. New bone (1), hydroxyapatite crystal scaffold (2), and bone marrow (3) were noted at ×200 magnification.

Discussion

Crestal sinus augmentation continues to evolve as clinicians seek minimally invasive methods that reduce patient morbidity while still delivering predictable regenerative outcomes. The Baranes-Yahav crestal approach pairs particularly well with Bond Apatite due to the material's unique handling characteristics and biologic behavior.

Bond Apatite hardens within minutes of placement, allowing it to stabilize the elevated Schneiderian membrane without supplemental membranes or tenting hardware. This characteristic is especially valuable in crestal sinus elevation procedures in which direct visualization is limited and maintaining space is essential for successful bone regeneration. Additionally, the material exhibits inherent bacteriostatic properties, protecting against contamination in a region accessed via a small osteotomy, where graft sterility is a concern.

Histologically, the biphasic resorption pattern observed in this study confirms the material's design intent. The calcium sulfate phase provides early structural stability and undergoes controlled resorption, encouraging initial bone ingrowth. As this phase diminishes, the HA phase remains and serves as a stable scaffold, supporting continued trabeculation and mineral deposition over time. The presence of osteoblasts directly lining the surfaces of HA crystals underscores the material's strong osteoconductive potential and indicates excellent cellular compatibility.

The substantially regenerated bone volume noted at 8 months is consistent with previous reports demonstrating Bond Apatite's ability to support implant placement after an

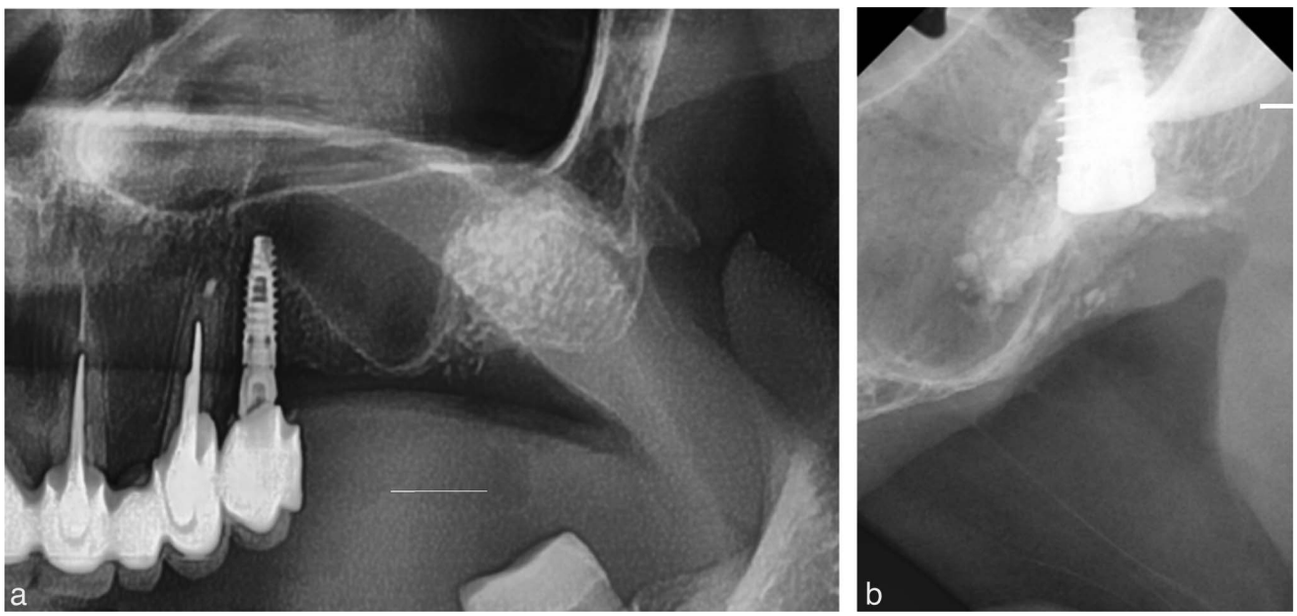

Figure 12. Radiograph following 8 months postgraft healing (a) and following implant placement (b).

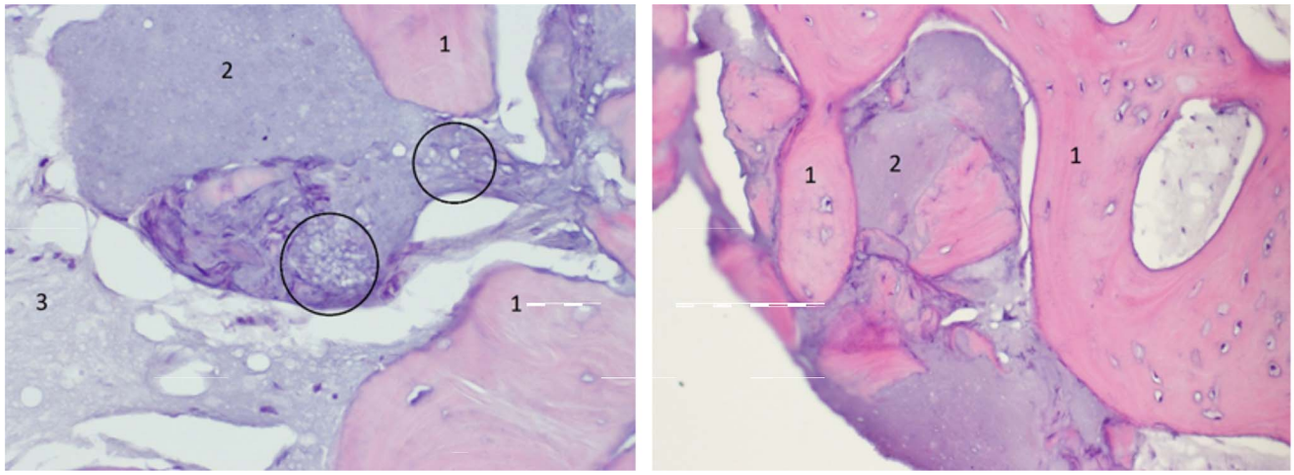

Figure 14. At higher magnification (×400), new bone (1), hydroxyapatite (HA) crystal scaffold (2), and bone marrow (3) are evident with scaffolds of HA crystal (circles).

appropriate healing period. The clinical and histologic outcomes observed here further indicate that combining this material with the Baranes-Yahav technique offers several advantages over traditional lateral window sinus augmentation. The crestal approach reduces surgical trauma, shortens recovery times, decreases postoperative discomfort, and minimizes overall operative complexity while still providing effective sinus membrane elevation and space creation. When used with a grafting material that does not require membranes, the entire regenerative process becomes more streamlined and predictable.

Taken together, these findings align with the broader movement in implant dentistry toward minimally invasive yet clinically robust procedures, offering patients and clinicians a reliable alternative to more invasive lateral window techniques without compromising long-term regenerative success.

Conclusions

Based on clinical experience, histologic evaluation, and supporting literature, Bond Apatite regenerative cement is well suited for crestal sinus augmentation using the Baranes-Yahav technique. The material provides stable space maintenance, predictable osteoconduction, slow and controlled resorption, and excellent regeneration with host bone without evidence of inflammatory response.

Sinus floor elevation in this series was performed via a minimally invasive crestal approach using the Baranes-Yahav technique, which is designed to protect the Schneiderian membrane while creating a controlled subantral space for graft placement. In the cases presented, after months of site healing, regenerated bone exhibited strong vascularity and structural maturity, allowing implants to achieve primary

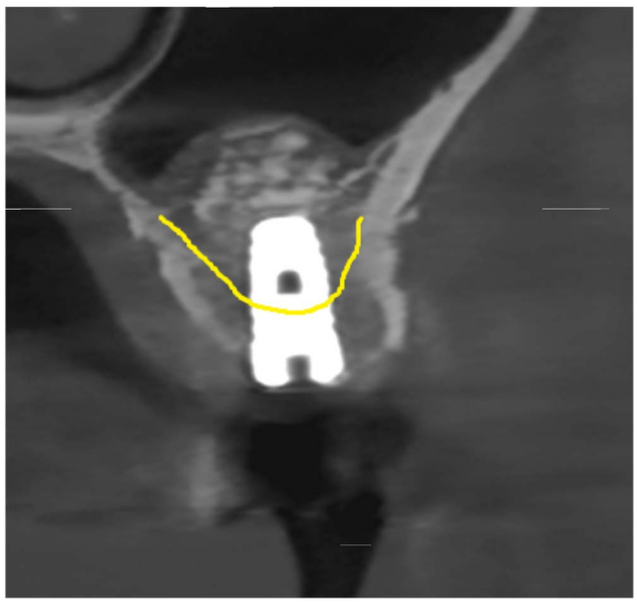

Figure 15. Cone beam computerized tomography cross-section following implant placement (yellow line indicating pretreatment sinus floor position).

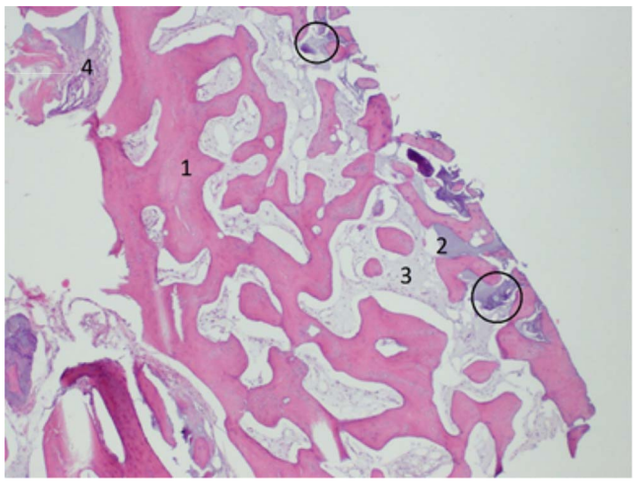

Figure 16. Histological analysis at ×100 noted new bone (1), hydroxyapatite (HA) crystals (2), and connective tissue (3) with the circle demonstrating small scaffolds of HA crystal.

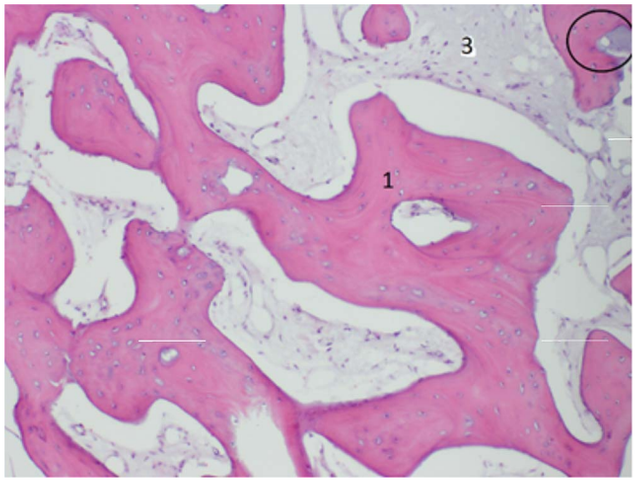

Figure 17. Histological analysis at ×200 noted new bone (1), hydroxyapatite (HA) crystals (2), and connective tissue (3) with the circle demonstrating small scaffolds of HA crystal.

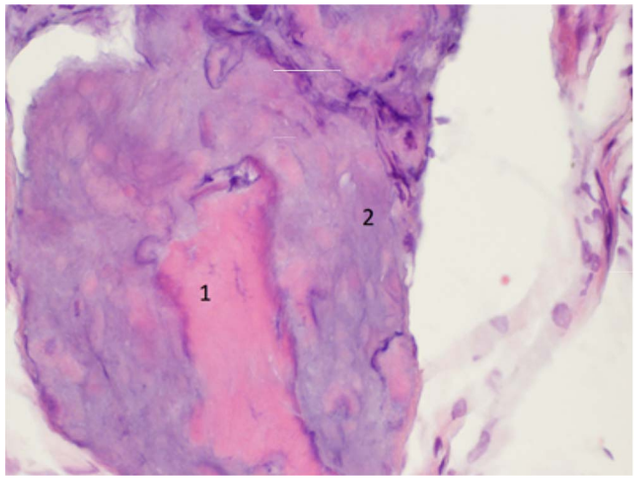

Figure 18. Histological analysis at ×400 noted new bone (1) and hydroxyapatite crystals (2).

stability greater than 25 Ncm at placement in type 3 or 4 bone in the posterior maxilla. The absence of complications and the high proportion of newly formed bone further support the material's clinical reliability.

The Baranes-Yahav technique, when combined with Bond Apatite, represents a safe, efficient, and highly predictable approach to sinus membrane elevation for clinicians who value minimally invasive regenerative procedures. Its simplicity and consistent outcomes position it favorably among contemporary sinus augmentation strategies.

Note

Dr. Baranes and Dr. Yahav developed the instruments utilized in the article. Dr. Yahav is the CEO of Augma Biomaterials.

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