Mechanism of bone formation Bond Apatite®

Bond Apatite®

Is a composite bone graft cement made of pure **Biphasic calcium sulfate** cement and Hydroxyapatite (HA) particles in a ratio of 2/1.

- The HA particles consist of various particles (PSD) that are by design distributed in sizes ranging from 90 microns to 1 mm.
- The HA particles function to slow down the overall resorption rate of the graft and maintain the graft volume, thus enabling it to be used in a wide variety of grafting procedures from small and simple bone deficiencies to large and more complex bone defect cases.
- The bone formation mechanism is entirely different from other conventional particulate grafting. While with conventional grafting materials there is **integration** with the particles of the graft that results in 20-25% of vital bone formation, with Bond apatite® there is **no integration** at all between the newly formed bone and the material is completely resorbed. Instead, new vital bone is formed in the process. The graft is completely transformed into the native bone of the patient. No graft is left behind; only **the patient's bone with 100% regeneration**.
- Since the material is a composite graft, it has two different resorption modes. The biphasic calcium sulfate, which is 2/3 of the graft, resorbs relatively quickly within 4-10 weeks while the HA particles, due to their unique controlled PSD, resorb as well but over a period of a few months.
- The small- and medium-sized HA particles resorb in 3-4 months. Meanwhile, the large size particles, which are less than 10%, remain for a more extended period, resorbing as well and after eight months disappearing almost entirely and being replaced by vital host bone.

How does it work

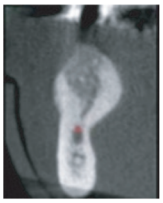
When Bond apatite® graft cement is placed into the defect site, a degradation process of the biphasic calcium sulfate component starts immediately.

- Calcium sulfate (CS) does not simply resorb. Instead, there is an interaction and a biological effect between calcium sulfate dissolution and bone growth, which stimulates bone formation significantly. Therefore, it is considered a bioactive material.
- While CS dissolves and recedes, it releases a vast amount of calcium ions. In a biological process, the calcium then precipitates into hydroxyapatite-like calcium phosphate mineral latticework, which acts as an osteoconductive trellis for new bone formation. This becomes incorporated into new bone and then remodels as the bone matures.
- The HA particles occupy 1/3 of the composite graft components and are intended to slow down the overall resorption of the graft. Those particles are different in size and shape and range from 90 microns to 1 mm. **They do not integrate with the bone.** Instead, during their resorption process, they are first encapsulated by connective tissue, then resorbed, and then the connective tissue undergoes ossification.
- Thus, 12 weeks post op, nearly 90% of the graft is replaced by the patient's own bone, while eight months post-op, almost no remnants of the graft can be seen due to the complete transformation of the graft into new vital bone.

Bond Apatite® Histology 3 months post op



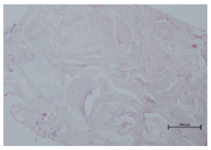

3 months post op



CBCT 3 months post op

Core harvesting 3 months post op

Implant in place



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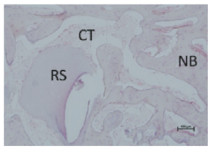

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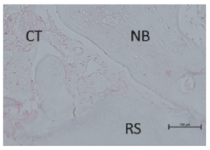
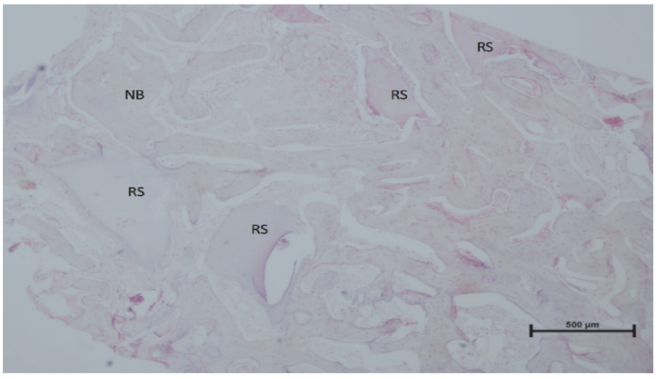


X20

The sample consists mainly vital new bone (NB) with osteocytes and vascular structures. Areas of residual scaffold were surrounded by /connective tissue and occupied ~10% of the sample area

NB-new bone
RS- residual scaffold
CT-connective tissue



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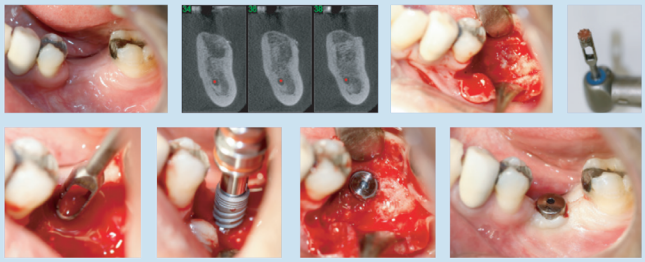
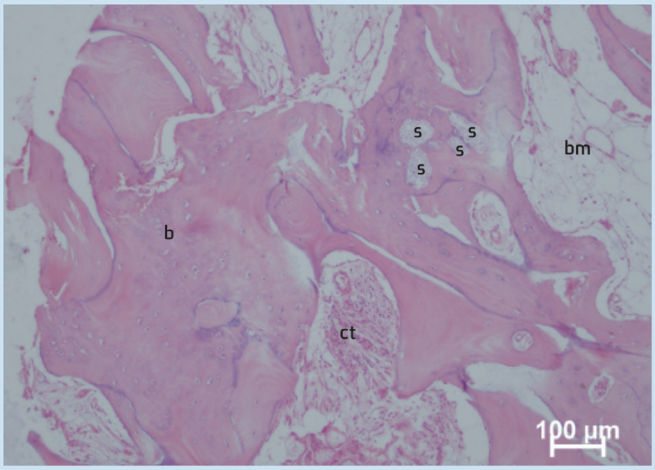
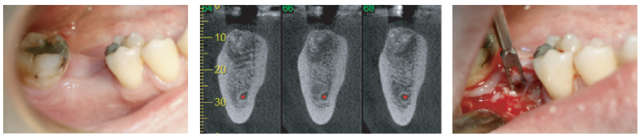
Bond Apatite® Histology 8 months post op

Core for histology was harvested after 8 months

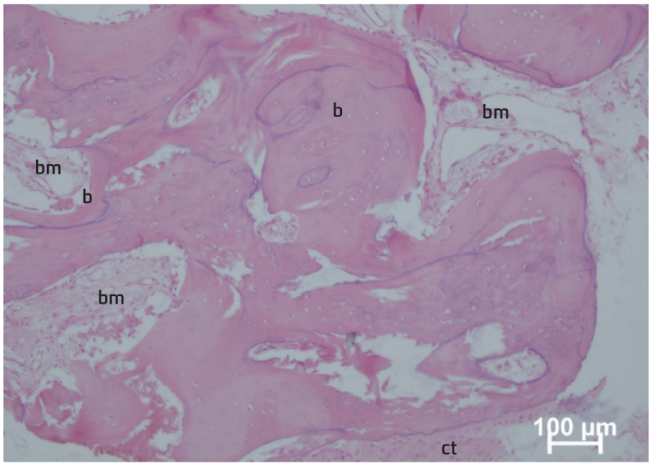




68 a (JH)
B- bone 79%
Bm- bone marrow 11%
Ct- connective tissue 7%
S –scaffold 3%



Core for histology was harvested after 8 months



69 (EH)
B –bone 67%
Bm- bone marrow 21%
Ct- connective tissue 8%
S-scaffold 4%

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It's my bone!

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