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Osseodensification for sinus graft and ridge expansion

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During bone densification drilling, bone tissue is compressed and autografted in the direction of external expansion. For bone densification, alveolar bone augmentation or maxillary sinus autogenous bone graft can be carried out. A 67-year-old female was presented with the chief complaint of wanting implant restoration on the left maxillary posterior region. After sinus autograft was performed using a densha bur with a concept of osseodensification drilling, the implants were placed. A 73-year-old female whose treatment plan was implant installation after tooth extraction due to trauma. The implants were placed through the osseodensification drilling for better implant stability by using the densha bur that can exhibit bone expansion effect in the narrow ridge. Applying osseodensification drilling's bone preservation and condensation ability through autografting compaction, sinus autograft or ridge expansion can be carried out clinically. **(THE JOURNAL OF KOREAN ACADEMY OF OSSEOINTEGRATION 2020;12(2):70-74)**

Key words: Bone densification drilling, Bone compaction, Bone autograft

INTRODUCTION

In dental implant placement, sufficient bony bulk and density are essential factors for good bone-to-implant contact (BIC) and primary stability. A new osteotomy technique termed as osseodensification was introduced by Huwais in 2015[1]. The densah bur is specially designed with the concept of osseodensification. Specially designed densah burs precisely cut bone in the clockwise direction and densify bone in a non-cutting counterclockwise direction combined with copious irrigation which facilitates the surgical technique during implant placement. This specially designed Densah bur cuts the vital bone clockwise and densifies the bone counterclockwise to allow bone compaction to occur with copious irrigation. There are many flutes in Densah bur, and osseodensification takes places at this flute back rake angle. Densha bur has cutting chisel edges and tapered shanks to deliver bone chips and debris to the implant in the inward direction. In the outward direction, pressure is applied along with irrigation to achieve hydrodynamic compression. This compresses the bone laterally[2]. Densah bur has a tapered shank, so the deeper it goes into the osteotomy site, the wider the diameter of the drill, and the osteotomy site gradually widens. In cutting mode, the osteotomy is first carried out with clockwise rotation, and then the osseodensification is led by counterclockwise rotation in densifying mode. The autografted bone is condensed in the inner layer of the implant, which increases the BIC and increases the insertion torque[3-8]. In a paper that introduced the concept of osseodensifcation drilling in 2017, the bone densifcation method increased the insertion torque of implants placed using standard drilling techniques from 25 Ncm to 49 Ncm in low-density bone[9]. The percentage of bone at the implant surface was approximately three times for implants prepared with osseodensification compared with standard drilling[9]. In addition, the diameter of the osseodensification bur was smaller than that of the conventional osteotomy bur even though the same bur was used for drilling as a spring-back effect of bone elastic strain. Therefore, it may be more useful in the maxilla than the mandible because the cancellous bone/cortical bone ratio is higher. In addition, copious irrigation is considered necessary to prevent necrosis of surrounding osteoblasts during implant drilling preparation.

Narrow ridges are shown to expand in width along with OD thus facilitating for placement of large diameter implants and also avoiding of fenestration and deshiscence defects[10].

The author's report cases showing the effect of bone expansion and sinus elevation in patients with D4 bone quality.

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CASE REPORT

Two patients' treatment plan was to place dental implants on maxillary area in the outpatient clinic of Oral and Maxillofacial Surgery Department faculty of Ewha Womans University. One had insufficient alveolar bone depth to the sinus floor and the other had insufficient alveolar bone width.

This is the first case that achieved the effect of sinus elevation. A 67-year-old female was presented with the chief complaint of wanting implant restoration on the left maxillary posterior region. #25 had been extracted last year, #27 had been extracted 3 years earlier due to chronic periodontitis. #26 was hopeless teeth with PD over 10 mm. After an initial intraoral examination, treatment option of implant-supported prosthesis was discussed with patient; she agreed to the implant-supported prosthesis after tooth extraction as this was more predictable and conservative to teeth. The patient had a medical history of angina pectoris, coronary artery disease (one vessel) and diabetes mellitus. After medical consultation, there was no contraindication for surgery.

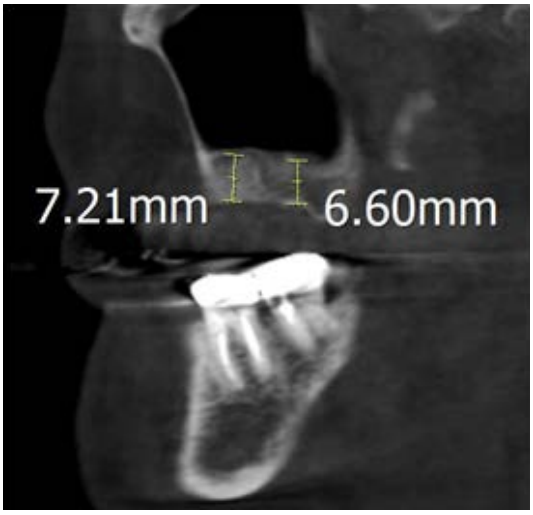

Figure 1. The height of alveolar bone.

The treatment plan was bone graft after #26 extraction, and implant installation was carried out 6 months later. #26 was extracted and socket preserved using xenogenic graft (a blend of granules of deproteinized bone and pocrine collagen fibers; Bio-Oss® collagen; Geistlich® 250 mg, Bio-gide® 25 × 25 mm).

After 6 months, cbct was taken. On radiographic evaluation, the height of alveolar bone to sinus floor was about 6 to 7 mm (Figure 1). The height was not sufficient to place the planned 8.5 mm depth implant. The bone quality expected through cbct was D4. The housefield unit in the area was about 700.

Considering that the alveolar bone height was insufficient and the bone quality is D4, a treatment plan was established to place 10 mm length implant using a densah bur that can carry out osseodensification. 7 months after tooth extraction and socket preservation, osstem® TS III 4.0 × 8.5 mm (Diameter × Length) were placed at sites #26 and 27 along with bone grafts using Bio-Oss® 0.25 g in the area where peri-implant bone was insufficient. The treatment procedure was as follows (Figure 2).

A. Under local anesthesia, pilot clockwise drill down to 1 mm below the sinus floor.

B. Bone densification counterclockwise and 1500 rpm drlling. Start with a 2.0 mm diameter counterclockwise bone densification drill and gradually increase the diameter to 4.0 mm. In the meantime, advance past the sinus floor in increments of 1 mm.

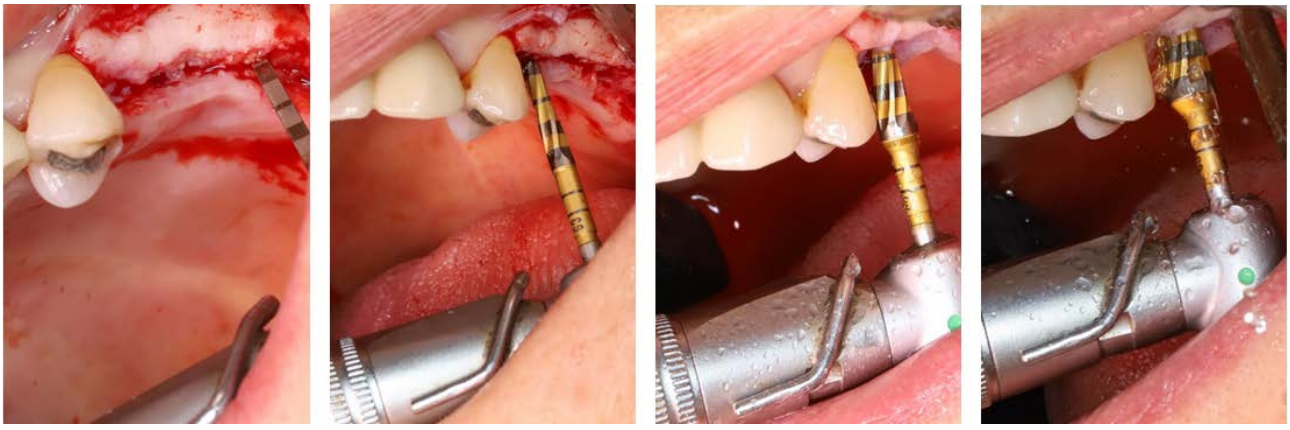

Figure 2. Start with pilot clockwise drilling down to 1 mm below the sinus floor. After pilot drilling, in turn, start with 2.0 mm diameter counterclockwise osseodensification drilling and gradually increase the diameter to 4.0 mm. At the same time, advance past the sinus floor in increments of 1 mm.

C. Finally place the implants to the depth. Healing abutment 5.0 × 5 mm (Diameter × Length) were also signed at the same time.

Cbct was taken after 1 week. On radiographic evaluation, radiopaque line below #26i, 27i implants were seen (Figure 3), indicating bone compaction. This demonstrates the ability of bone densification drilling to perform sinus autograft without sinus membrane elevation and sinus bone graft. After 4 months follow up, RSQ was performed. #26i, 27i implants' ISQ was over 70.

It was not a narrow ridge, but this is the second case of bone expansion in the alveolar bone ridge. A 73-year-old female whose treatment plan was implant installation after tooth extraction due to trauma. At the time of the emergency room visit due to trauma, #12 and #22 were avulsion state and #21 was intrusion state. As first aid, the toothe rws (resin-wire splinting) was performed. Splinting was performed for 2 months and the prognosis was poor, so extraction and bone graft were performed. The treatment plan was to place 3 dental implants in the maxillary anterior region after 6 months.

The patient had a medical history of hypertension, benign paroxysmal positional vertigo, localization-related epilepsy. After radiographic and clinical evaluation, the height of alveolar bone to nasal floor was sufficient about 12 mm (Figure 4), but the width of alveolar bone was insufficient, about 4 to 6 mm (Figure 5). The cancellous bone center was more than 3 mm, and the cancellous bone/cortical bone ratio was more than 1/1. The bone quality expected through cbct was D4.

Since the alveolar bone width was insufficient, we tried to secure a sufficient width to place the dental implant by utilizing the point that bone compaction occurs around the implant when drilling through densah bur. Osstem® TS III 3.5 × 10 mm (Diameter × Length) were placed at maxillary anterior region. The treatment procedure was as follows.

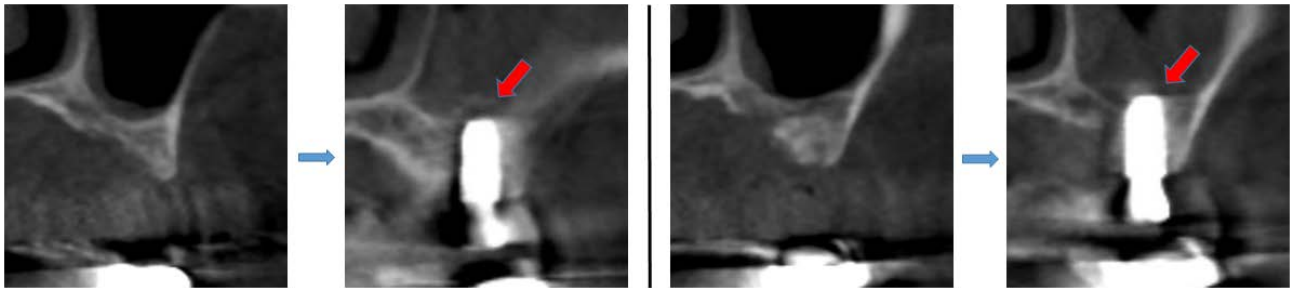

Figure 3. Figure on the left side is pre-operation figure and post-operation figure of #26i, and figure on the right side is pre-operation figure and post-operation figure of #27i. In the post-operation figure of the two implants, a rediopaque line is seen below the implants.

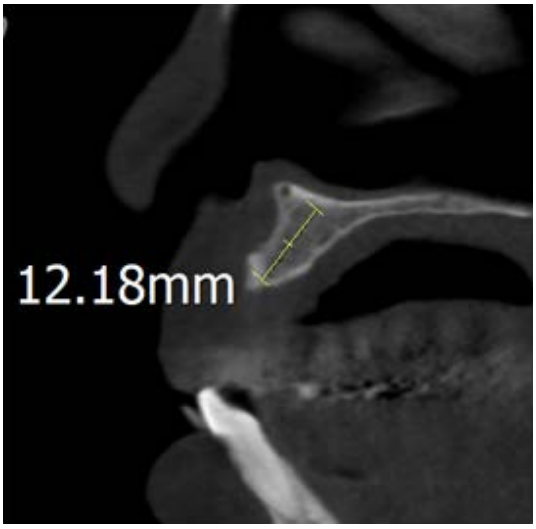

Figure 4. The height of alveolar bone.

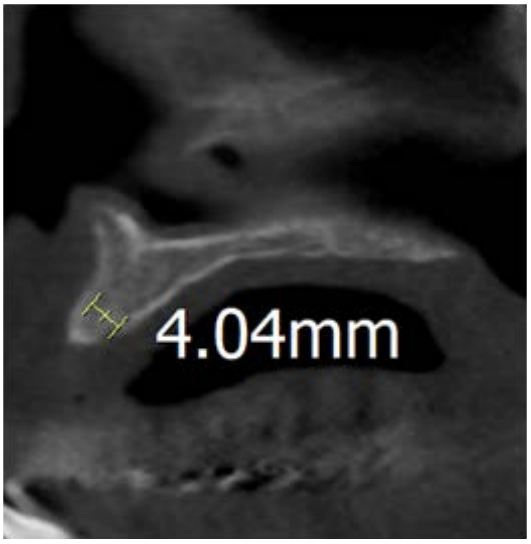

Figure 5. The width of alveolar bone.

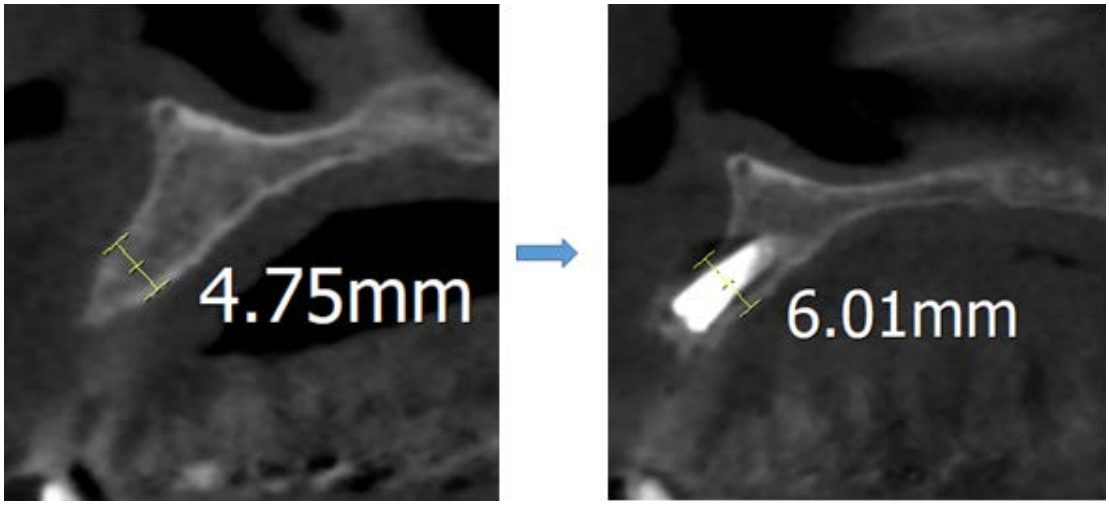

Figure 6. Pre-op, post-op of #12i.

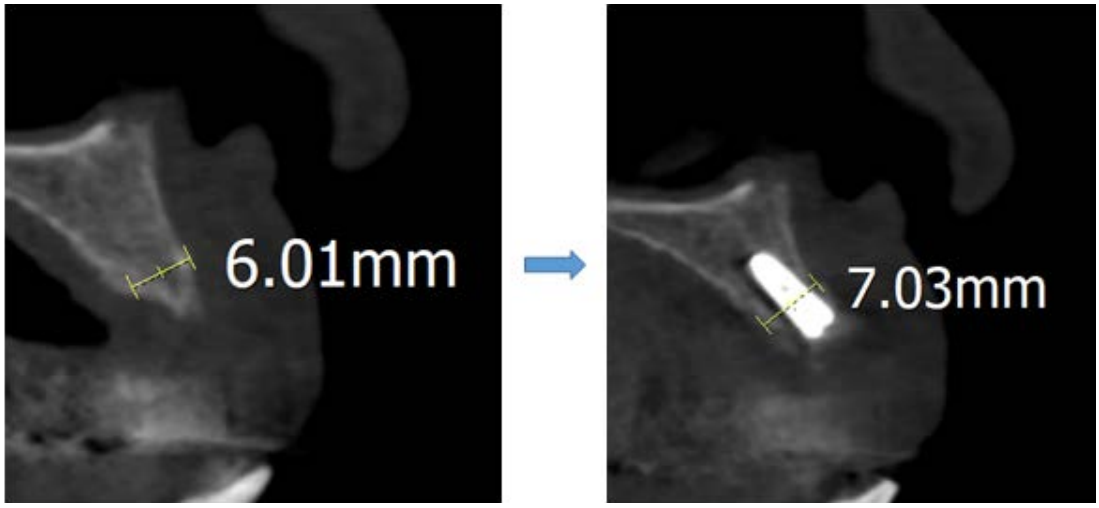

Figure 7. Pre-op, post-op of #21i.

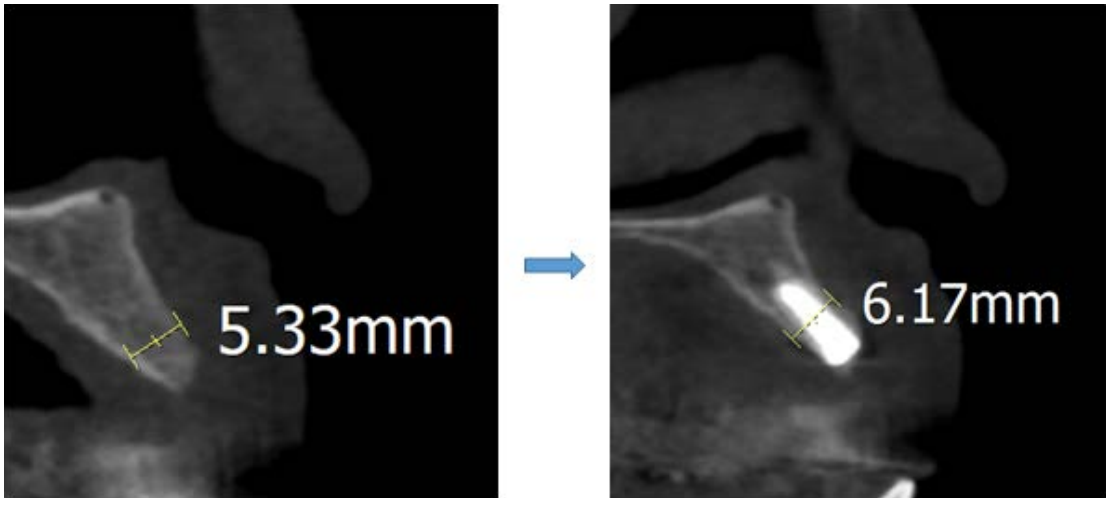

Figure 8. Pre-op, post-op of #22i.

A. Under local anesthesia, pilot clockwise drill with the narrowest drill.
B. Bone densification counterclockwise and 1500 rpm drlling. Start with a 2.0 mm diameter counterclockwise bone densification drill and gradually increase the diameter to 3.0 mm.
C. Finally place the implants to the depth. Cover screw were signed at the same time due to insufficient initial torque.

Cbct was taken after 1 week. On radiographic evaluation, bone thickness was increased. The alveolar bone thickness increased from 4.75 mm to 6.01 mm, from 6.01 mm to 7.03 mm and from 5.33 mm to 6.17 mm at the #12i, #21i, #22i sites, respectively (Figure 6~8). When follow-up after 4 months, the second implant surgery was performed and all of the ISQ were above 70.

DISCUSSION AND CONCLUSION

Unlike conventional bridge prosthesis restorations, dental implants can restore the function and aesthetics of teeth without damaging adjacent natural teeth, so they are widely used as the primary choice for restoring teeth that are nonrestoarable or lost due to trauma, dental caires, etc.. However, in the case of maxillary anterior region, there are many cases where the alveolar bone ridge is narrow, and in the case of the maxillary posterior region, management considered to be challenging due to the quality of alveolar bone. Osseodensification concept has been proposed in many literatures in order to improve primary implant stability, which is an important aspect for osseointegration. Densah bur is novel drills specially designed to enhance bone density by Osseodensification, which in turn increases primary stability. In our case, considering that sinus autograft or bone expansion was achieved through osseodensification drilling and the implant's ISQ was high, osseodensification drilling not only improved the long term stability of the implant, but also other surgical advantages such as sinus autograft and bone expansion. However, the number of cases was inssuficient and more randomized clinical trial is needed for further study.

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