CASE REPORT

Lateral Bone Window Approach with Micros Mini Bone Scraper for Sinus Floor Elevation

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Abstract

Objective The purpose of this article is to describe a technique with a mini bone scraper for lateral bone window approach and simultaneous bone harvesting during sinus floor elevation.

Methods This study included five consecutive patients with the atrophic posterior maxilla. After elevation of mucoperiosteal flap, a bone window was then opened safely using a Micros Mini Bone Scraper[®] with small shape and easy handling. Data were recorded on the residual alveolar bone height, number of implants, site of implant placement, collected particulate bone volume, and bone harvesting time.

Results There was no injury of the Schneiderian membrane, and one to two implants of 11.5 mm length were placed simultaneously after sinus floor elevation in all cases. Mean residual bone height was 4.6 mm. The mean volume of particulate bone collected from the anterior wall of the maxilla using this technique was 0.74 cm³. Supplementary allogeneic materials were not required in all cases. Mean bone harvesting time was 4.6 min.

Conclusions Our technique with Micros Mini Bone Scraper[®] is a simple and safe procedure in lateral bone window approach and simultaneous bone harvesting during

sinus floor elevation, because it is performed under better visualization of the membrane without irrigation.

Keywords Lateral bone window approach · Sinus floor elevation · Bone scraper · Particulate bone graft

Introduction

Successful placement of dental implants in the posterior maxilla within the absent tooth area is often compromised by insufficient vertical height and transversal width of the alveolar crest and poor bone quality [1, 2]. When there is generally less than 5 mm of bone remaining between the crest of the maxilla and the floor of the sinus, bone augmentation must be considered [2]. Tatum [3] introduced a technique using the lateral bone window to increase maxillary bone height by placing a graft material between the maxillary sinus floor and its mucosa (the Schneiderian membrane), and sinus floor elevation is an important therapeutic option in the treatment and rehabilitation of the edentulous posterior maxilla [4]. Because of the very thin Schneiderian membrane and complicated sinus structure, there is risk of damaging the membrane when cutting the bone with a bur or surgical saw. Many modifications of Tatum's technique have therefore been studied and reported to avoid injury of the Schneiderian membrane, including trephine bur osteotomy or piezoelectric bone device techniques [3–10]. As a modified technique of the conventional lateral window approach, we describe the use of a mini bone scraper for lateral bone window approach and simultaneous bone harvesting during sinus floor elevation.

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Patients and Methods

This study included five consecutive patients with atrophy of the posterior maxilla, showing 6 mm or less residual bone height on CT and panoramic radiograph (Figs. 1, 2). All patients consented to a treatment plan with sinus floor elevation and simultaneous implant placement. After a crestal incision with lateral release incision, the mucoperiosteal flap was raised and the anterior wall of the maxillary sinus was exposed. A bone window was then opened safely using a Micros Mini Bone Scraper® (Generalmedical, Devizes, UK) which is a 15-cm-long and 4-mm-diameter bone collection instrument (Figs. 3, 4, 5, 6). This instrument can obtain bone particles with easy handling (Fig. 7). The graft is harvested with blood, which provides it biological plasticity shortly after collection. The collected particulate bone was measured in the syringe and inserted in the cavity after sinus floor elevation and simultaneous implant placement (Figs. 8, 9). Finally, the mucoperiosteal flap was replaced and closed. In each case, data were recorded on the residual alveolar bone height, number of implants, implant diameter and length, site of implant placement, collected particulate bone volume, and calculation of bone harvesting time (Table 1). At second-stage surgery, implant stability was measured using a Periotest® (Medizintechnik Gulden, Germany).

Results

Five sinus floor elevations with this technique were performed, and there was no injury of the Schneiderian membrane in all cases. Mean residual bone height was 4.6 mm (range 3–6 mm). In all cases, implants with

Fig. 1 Cross-sectional image of CT shows atrophic bone in maxillary premolar area

Fig. 2 Panoramic radiograph shows less bone to the maxillary sinus in the maxillary second premolar

Fig. 3 Lateral window approach for sinus floor elevation using the Micros Mini Bone Scraper®. Both opening of the anterior wall of the maxilla and bone harvesting are performed

Fig. 4 Bone collection instrument: Micros Mini Bone Scraper® (15 cm long and 4 mm in diameter)

11.5 mm length were placed simultaneously and good initial stabilization was achieved intraoperatively. The mean number of placed implants was 1.4 (range 1–2), and the mean volume of particulate bone collected from the

Fig. 5 Opening of lateral bone window using this technique. The Schneiderian membrane is exposed

Fig. 8 Bone grafting after the sinus floor elevation and simultaneous implant placement

Fig. 6 Particulate bone harvested by Micross Mini Bone Scraper®

Fig. 7 Collected particulate bone measured in the syringe

anterior wall of the maxilla using this technique was 0.74 cm^3 (range $0.7\text{--}1.0 \text{ cm}^3$). Supplementary allogeneic materials were not required in all cases. Mean bone harvesting time was 4.6 min (range 4–5 min). When there was alveolar bone defect after dental implant placement, collected bone also was grafted at the site as well as the sinus.

Fig. 9 Panoramic radiograph after sinus floor elevation and simultaneous implant placement

Second-stage surgeries were performed because CT showed good bone formation 5–7 months after initial operation. All dental implants were clinically asymptomatic and sufficiently osseointegrated with a Periotest measurement between 0 and -4 (Table 1).

Discussion

Sinus floor elevation is performed in classic lateral window approach reported by Tatum [3] or a modified approach. There are three main procedures to open the lateral bone window:

1. Using a ball bur to cut a surface area of variable dimensions until visualization of the Schneiderian membrane by the change in color.
2. Using a fine bur to cut a rectangle or circle that includes only the ridge until the entire perimeter of the membrane is visualized. A green stick fracture is then performed such that the bone surface within the cut perimeter is introduced into the sinus, placed on what will be the new sinus floor.

Table 1 Characteristics of patients who underwent lateral bone window approach with Micros Mini Bone Scraper for sinus floor elevation

Patient no.	Bone height (mm)	Number of implants	Implant diameter and length	Site	Collected particulate bone (cm ³)	Grafting material	Calculation of bone harvesting time (min)	Surgical method	Periosteal
1	3.0	1	3.8 × 11.5	25	1.0	None	5	Simultaneous implant placement	–4
2	5.0	2	3.8 × 11.5 × 2	25 26	0.7	None	4	Simultaneous implant placement	–1 –2
3	4.0	1	3.8 × 11.5	15	0.9	None	5	Simultaneous implant placement	–4
4	6.0	2	3.8 × 11.5 × 2	25 26	0.8	None	4	Simultaneous implant placement	–2 –4
5	5.0	1	3.8 × 11.5	27	0.7	None	5	Simultaneous implant placement	0
Average	4.6	1.4	11.5		0.74		4.6		–4

3. Performing a complete osteotomy by antral approach on the external side of the maxilla, fully releasing the bone fragment demarcated by the fenestration and exposing the Schneiderian membrane.

After each of the above procedures, the Schneiderian membrane is then detached and elevated for bone graft. However, there is potential risk of damaging the thin membrane during lateral wall approach by pressing of bur as well as elevating the membrane. Therefore, piezoelectric bone devices have been recently introduced as a safer technique to avoid such damage [3–9]. However, the use of irrigation leads to scraped bone being washed away by the solution and lost, even if piezoelectric bone device was used [11].

Our technique with Micros Mini Bone Scraper® is a simple and safe procedure in lateral bone window approach because it is performed under better visualization of the Schneiderian membrane without irrigation, and it has a lower risk of the injury of the Schneiderian membrane compared with conventional techniques using a rotary drill, bur or surgical saw [2, 3, 6]. Their scraper design is a 15-cm-long and 4-mm-diameter bone collection instrument which has the blade in the front end of the device. Bone is removed by pressing the blade on the bone surface while pulling it back. Bone can be removed from flat and hollow surface with a working angle between 5° and 50°. They can change the angle and pressure to change amount and consistency of the removed bone. It can contain a volume of up to 0.25 cc at one time. Furthermore, our technique can allow simultaneous autogenous bone harvesting during opening the lateral bone window and avoiding further incisions or larger mucoperiosteal flaps to uncover new areas for obtaining autogenous bone. Our technique with Micros Mini Bone Scraper® may require longer time for lateral

bone window opening than conventional technique using a bur or piezoelectric bone device. However, because the mean time of our technique is 4.6 min, time till bone graft may not be different when harvesting bone from other oral sites after conventional lateral bone window opening. As similar procedure, Martos Díaz et al. [11] performed 10 sinus floor elevations with Safescraper®. As a complication, there was only one intraoperative membrane perforation, which was <1 mm and did not entail interruption of the procedure. However, our technique had no perforation of the membrane, because Micros Mini Bone Scraper® has smaller shape and easier handling than Safescraper®.

The amount of graft harvested by this technique is variable, because the thickness of sinus wall differs among patients. According to Martos Díaz et al. [11], mean bone volume harvested from opening of the lateral wall of the maxillary sinus was 0.56 cm³ (range 0.4–0.7 cm³), and supplementary allogeneic materials were required because collected bone volume was insufficient in 2 of 10 sinus floor elevations. Collected bone volume of the 2 sinus floor elevations was 0.5 and 0.7 cm³, respectively. Both required 2 dental implants, but simultaneous implant placement was not performed for one patient with 3.5 mm previous bone height. In our technique, the mean volume of particulate bone collected from the anterior wall of the maxilla was 0.74 cm³ (range 0.7–1.0 cm³) and supplementary allogeneic materials were not required in all cases. The mean volume of particulate bone obtained by this technique was very similar to the volume of commercially supplied allogeneic materials, which usually ranges from 0.5 mm to 1 cm³ [11]. Although small amount of bone graft does not require allogeneic materials, harvesting from other anatomical sites or grafting of allogeneic materials is required when the graft obtained from the lateral wall of the maxillary sinus is insufficient. In such situation, we can

perform harvesting from bone around lateral wall window without exposure of the Schneiderian membrane or minimally invasive bone harvesting from zygomatic buttress area using tunneling technique with Micros Mini Bone Scraper®.

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