An indirect sinus floor elevation by using piezoelectric surgery with platelet-rich fibrin for sinus augmentation: A short surgical practice

Ali H. Neamat, Shakhawan M. Ali, Saman W. Boskani, Payman Kh. Mahmud

ABSTRACT

Introduction: The aim of this surgical practice is to present a case report to describe a technique for sinus floor augmentation of an atrophic posterior maxilla by platelet-rich fibrin (PRF) has been used as a graft material with a one-step crestal approach (indirect sinus lift) where the residual bone is less than 7 mm in the atrophic posterior maxilla. Sinus floor elevation was performed with a crestal approach by using piezosurgery.

Case Report: A 38-year-old female with an atrophic right posterior maxilla was treated with sinus floor augmentation and immediate implant placement using PRF as the sole graft material in our implant clinic, maxillofacial department, Sulaimany teaching hospital prior to surgery the residual bone height was approximately 2–4 mm but six months after surgery, orthopantomogram show that the use of PRF as a graft material during sinus floor augmentation induces natural bone regeneration.

Conclusion: Herein, illustrate a minimally invasive procedure aimed at sinus floor elevation with immediate implant placement by crestal approach, PRF only is a safer and easy available simpler technique than the protocol graft materials and piezosurgery device to prevent Schneiderian membrane perforation.
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Introduction: The aim of this surgical practice is to present a case report to describe a technique for sinus floor augmentation of an atrophic posterior maxilla by platelet-rich fibrin (PRF) has been used as a graft material with a one-step crestal approach (indirect sinus lift) where the residual bone is less than 7 mm in the atrophic posterior maxilla. Sinus floor elevation was performed with a crestal approach by using piezosurgery. Case Report: A 38-year-old female with an atrophic right posterior maxilla was treated with sinus floor augmentation and immediate implant placement using PRF as the sole graft material in our implant clinic, maxillofacial department, Sulaimany teaching hospital prior to surgery the residual bone height was approximately 2–4 mm but six months after surgery, orthopantomogram show that the use of PRF as a graft material during sinus floor augmentation induces natural bone regeneration. Conclusion: Herein, illustrate a minimally invasive procedure aimed at sinus floor elevation with immediate implant placement by crestal approach, PRF only is a safer and easy available simpler technique than the protocol graft materials and piezosurgery device to prevent Schneiderian membrane perforation.

Keywords: Immediate implants, Indirect sinus lift, Piezosurgery, Platelet-rich fibrin

INTRODUCTION

Dental implants are used to replace both the form and the function of missing teeth but an insufficient vertical height of the alveolar bone in the posterior maxillary area due to the presence of the maxillary sinus, poor quality and quantity of alveolar bone and post-extraction bone resorption may limit implant placement [1]. In such cases, several sinus augmentation procedures for implant placement have been introduced since the 1980s [2, 3]. The most widely used approaches for sinus lifting are...
direct sinus lifting approach and indirect sinus lifting approach. The indirect sinus lift procedure presents the advantage of being less invasive and less time to be cost compared to direct sinus lift. Using piezoelectric ultrasonic vibration (25–30 kHz), the piezosurgery device precisely drills the bone without cutting soft tissues, which remain undamaged even in a case of accidental contact (Figure 1) [4]. The piezosurgery device provides a clear surgical site, as it maintains a blood-free surgical field this allows improved visualization of the surgical area during bone cutting, due to the air–water cavitation effect of the ultrasonic instrument. The main advantage of the osteotome technique is that it improves bone density, which allows greater initial stability of implants also it is a less invasive procedure than lateral antrostomy [5]. After progressive preparation of the bone then the elevation of the sinus floor is obtained with a reduced operative time compared with other sinus graft procedures. The movement of the piezosurgery knife is very small, so the cutting precision is greater and causes less discomfort for the patient. The absence of macro vibrations makes the instrument more manageable and allows greater intraoperative control, with a consequent safer action in anatomically difficult situations. When using this instrument the clinician applies a very small amount of pressure which allows a very precise cut [6]. The techniques create space between the maxillary alveolar process and the elevated Schneiderian membrane, which is filled with various graft materials to maintain adequate space for new bone formation. Many graft materials have been applied to these techniques such as autogenous bone, allograft, xenograft, alloplastic bone, or combinations thereof [7, 8]. Although autogenous bone is considered to be the gold standard, but it creates another wound at the donor site. Thus, autogenous bone is not widely used in clinical practice. The other graft materials also have limitations, including the risk of infection, insufficient bone regeneration and increased overall cost. Accordingly, no graft material appears to be superior to the others.

Several studies have recently reported the application of PRF in dental implant surgery such as PRF mixed bone substitute or PRF has so far solely been used as a graft material for sinus augmentation using both the lateral and crestal approach [9]. Platelet-rich fibrin (PRF) was first reported in 2001 by Choukroun et al. as a second-generation platelet concentrate [10]. The application of PRF for sinus augmentation is a relatively easy surgical procedure and the clinical and radiological findings have been shown to have a good effect regarding new bone formation.

Platelet concentrates have been shown to be a promising scaffold for tissue regeneration. Platelet concentrates are autologous, easy to prepare at the chair side, and full of high concentrations of growth factors. In vitro studies have proved the effects of these signaling molecules on cell proliferation, migration, differentiation and matrix synthesis. In recent years, platelet concentrates have been applied in sinus floor elevation and bone grafting. Platelet-rich plasma (PRP), which was among the first generation of platelet concentrates, has been used with autogenous bone or a bone substitute in sinus augmentation but without significantly positive effects. Platelet-rich fibrin (PRF) is from the second generation of platelet concentrate products. Platelet-rich fibrin has many advantages over Platelet-rich plasma, including osteogenic ability, a simple preparation process, absence of extrinsic biological agents, and sustained release of growth factors. Previous studies have revealed the potential of PRF to promote endo-sinus bone regeneration and to reduce healing time after sinus floor elevation [11].

CASE REPORT

A 38-year-old female presented to our implant clinic, maxillofacial department, Sulaimany Teaching Hospital with multiple missing teeth. A clinical examination was done followed by the radiographic examination using OPG (Figure 2). On evaluation, it was found that the right premolar and molar region had only 2–4 mm bone and an indirect sinus lift procedure with immediate implant placement was planned. The anterior region had adequate bone height. Laboratory blood investigation was done and antibiotic prophylaxis was given 1 hour prior to the surgery.

Surgical phase

- Start by putting a butterfly cannula in cephalic vein of the patient and blood samples approximately 50 ml is collected put in 10 ml blood collection tubes centrifuged immediately in a table-top centrifuge at a rate of 3000 rpm for 10 minutes then in the test tube three layers are obtained after centrifugation (Figure 3). Platelet-poor plasma is a top most layer consisting of cellular PPP, Clot in the middle are PRF and RBCs at the bottom of the test tube. PRF in middle layer clot is then removed with sterile tweezers and separated from the underlying RBC layer using scissors and then put on a sterile dish (Figure 4).
  - Gave Local anesthesia and by no 15 blade crestal incision was made.
  - Envelop flap was reflected and it was found that the bone width was sufficient.
  - Initial depth was achieved using a marker drill 2 mm at a speed of 700 RPM with saline irrigation.
  - Then that piezoelectric device was used. The osteotomy began to continue osteotomy was preparation and come into contact with the sinus membrane (Figure 1).
  - The sinus was lifted indirectly by using sinus elevation instruments. After that, the PRF material was inserted.
  - A final osteotomy was done then W&H Implant motor driven at 40 rpm and 20 Ncm torque.
After selecting a proper size and diameter three fixture were placed 2 of them D 5 mm* L 6 mm, While the other D 3 mm* L 13 mm.

- Put Cover screw and suturing was done using multifilament 3-0 absorbable polyglactin sutures.
- Orthopantomogram (OPG) was taken directly postoperative (Figure 1B). Also, the patient was instructed to the cold application for two hours after the operation, maintain the oral hygiene, mouthwash with antibiotic, analgesic and good follow-up.
- Implant loaded after four months (Figure 5).
- After six months OPG showed more than 3 mm bone regeneration by PRF around the implant (Figure 6).

DISCUSSION

Advancement in dentistry continues, placement of implant has become the most preferred means of replacement of missing teeth. In posterior maxilla because of the maxillary sinus in most of the cases presents a problem. Solution to these cases it is necessary to elevate the sinus floor and increase the bone height before implant placement. Direct sinus lift and indirect sinus lift are the most commonly used techniques. In the direct technique, the sinus is approached through the lateral window

- Figure 1: Ultrasonic piezoelectric device. This device works in hard tissue, not in the soft tissue. Therefore, membrane perforation is rare when breaking sinus floor (Courtesy Pr. Dong-Seok Sohn) [12].
- Figure 2: (A) Preoperative image showing atrophic right maxillary bone less than 2–4 mm in the molar region. (B) Directly postoperation implant in situ after sinus left.
- Figure 3: Platelet-rich fibrin procedure (Courtesy Pr. Dong-Seok Sohn) [12].
- Figure 4: Platelet-rich fibrin on sterile dish after separation ready for use.
- Figure 5: Operation outcome successfully after four months.
- Figure 6: Showing amount of bone regeneration by PRF in two different times. (A) Three months after the operation, and (B) Six months after the operation.
technique most of the time whereas indirect technique follows a crestal approach. Herein this article the indirect sinus lifting approach using sinus elevation instruments has been followed by increasing the bone height and also piezosurgery has advantages of micrometric bone cut to provide precise bone cut and of working in only hard tissue, not in the soft tissue easily getting tactile sense of the sinus membrane during osteotomy to the sinus floor, and reducing the risk of perforation of sinus membrane. The crestal approach for sinus augmentation provides 97% success rate, by minimizing Schneiderian membrane perforation and the bone would form around the implant in four months and could be loaded [13]. But the only disadvantage of this technique is that it is a blind procedure and only 3–4 mm sinus elevation can be achieved.

The present case showed a bone height of 2–4 mm before operation radiographically and the sinus floor was elevated up to 3 mm for the placement of an implant of 6 mm length and 5 mm diameter. But according to the study conducted by Ahn et al. the mean height of the residual alveolar process was 5.8 (0.9) mm, whereas mean elevation of the sinus floor was 6.2 (0.4) mm using indirect sinus lift. The study by Fornell et al. [14] showed a mean bone gain of 3 mm without any marginal bone loss after 3–12 months which was similar to the present case report.

CONCLUSION

Really most of the time placement of implants can be difficult due to compromised situations especially in the posterior maxillary region, by good evaluation and use the various techniques available it is possible to provide a good treatment outcome. The indirect sinus lift procedure and platelet-rich fibrin used as the sole graft material for sinus augmentation along with immediate implant placement helps to reduce the treatment time in patients. Herein by keeping the treatment procedure, simple successful rehabilitation can be achieved. The piezosurgery technique is a predictable sinus augmentation method without having to use the striking of a mallet. It may be a good choice at an implant site that has at least 3-mm residual bone under the maxillary sinus floor because it reduces the possibility of membrane perforation. It also reduces surgical time and discomfort to the patient.

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Acknowledgements

We would like to thank ministry of health Kurdistan regional government and implant department at a Sulaiman teaching hospital for made a facility to this operation.

Author Contributions

Ali H. Neamat – Substantial contributions to conception and design, Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Shakhawan M. Ali – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Saman W. Boskani – Substantial contributions to conception and design, Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Payman Kh. Mahmud – Substantial contributions to conception and design, Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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