ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 3, Issue – 3, May - 2020, Page No. : 289 - 294

Implant placement in the narrow bone using an adapted micro-fracture technique: Case study on two clinical patients

[1]Branimir Beus, Alpha Dental Clinic, Hrvatskih Zrtava 166A, Seget Donji, Croatia

[2]Dr. Dent. Med. (DDS), Alpha Dental Clinic, Hrvatskih Zrtava 166A, Seget Donji, Croatia

Corresponding author: Branimir Beus, Alpha Dental Clinic, Hrvatskih Zrtava 166A, Seget Donji, Croatia

Citation of this Article: Branimir Beus, Dr. Dent. Med. (DDS), "Implant placement in the narrow bone using an adapted micro-fracture technique: Case study on two clinical patients", IJDSIR- May - 2020, Vol. – 3, Issue -3, P. No. 289 – 294.

Type of Publication: Case Report

Conflicts of Interest: Nil

Abstract

Implant placement in the narrow bone is one of the challenges in dental implantology today. There are situations where bone splitting and bone spreading cannot be performed successfully. Those situations are usually dealt with by using two-stage bone grafting. In this paper, adapted micro-fracture technique will be explained as a possible solution for some of those situations, as an alternative to two-stage bone grafting. The purpose of the technique is to place an implant in the very narrow bone, using small and carefully controlled fractures as the way to widen the bone and induce healing. Two clinical cases will be presented, one in softer bone, and one in harder bone.

Keywords: Dental implant, narrow bone, bone manipulation, alveolar bone split, alveolar bone spreading, bone grafting, micro fracture

Introduction

Implant placement in the narrow bone is a common issue in dental implantology. Clinical patients often seek treatment several years (or decades) after the natural tooth has been lost, which usually causes bone resorption [1] [2]. In such cases, the bone quantity, especially bone width in vestibular-lingual direction (or vestibular-palatal in maxilla) might not be sufficient for implant placement.

In practice, the solution for this issue is the use of bone manipulation procedures, such as Guided Bone Regeneration (GBR), bone splitting and bone expansion [2].

In GBR, the goal is to achieve the growth of new bone, using autologous bone or exogenous bone material [3]. That material is sometimes used together with platelet-rich fibrin (PRF), to further increase the bio-potential of the the newly formed bone [4]. In GBR, it is very common to also use different membranes [5].

In bone splitting and bone expansion procedures, the goal is to change the shape of the already existing bone, in order to minimize the bone loss during the implant placement [2].

Both of these techniques have their limitations. Bone expansion is limited by the physical properties of the bone,and mostly can be used for frontal bone in maxilla,

in bone types III and IV (softer bone) [2]. Bone splitting technique creates one large buco-palatal (or buco-lingual) split. It is also limited mostly to maxilla, as mandibular sites usually do not meet the demands for bone splitting [2].

In this case study, adapted micro-fracture technique will be used to place the implant in very narrow bone site.

Clinical Case 1

The patient, a 45 year old caucasian female, came for placement of premolar dental implants (i.e. upper left teeth 4 and 5, or teeth 24 and 25 in standard ISO tooth notation system by World Health Organization) [6]. The patient claimed that both teeth had been taken out at least a decade ago. After the clinical examination and palpation of the tissue in the position of the first premolar (upper left 4, 24), it was concluded that the bone width was not sufficient for placing a dental implant.

Cone beam computed tomography (CBCT) was suggested to determine the exact width of the bone. However, it was declined by the patient due to the worries about radiaton exposure. After repeated detailed palpation of the premolar area, it was decided to access the area operationally and try to place an implant in the position of tooth 24 using adapted micro-fracture technique. The bone in the position of the second premolar (upper left 5, 25) was wide enough to place dental implant using standard technique, without the micro-fractures.

Surgical scalpel No.15 (Thermo Fisher, USA) was used to open a surgical site and standard mucoperiostal flap was raised to access the bone. Visual inspection of the bone revealed that the bone was too narrow for a 3.75mm diameter dental implant, as expected. Adapted micro-fracture technique was chosen as the most suitable bone manipulation method.

Usually, the first instrument used is surgical scalpel No.15 (TermoFisher, USA).

It is used on the crestal part of the bone to mark the line for the separation of the vestibular and palatal plate. Then, usually the narrowest D-shaped Tatum osteotome D1 (Tatum Surgical Inc., USA) is used to create some separation of vestibular and palatal (or lingual) cortical plate [2]. However, in very narrow or hard bone, it is often impossible to create a regular bone split. In those cases, adapted micro-fracture technique could be an alternative to bone grafting. If some separation of cortical plates is achieved, even only 2-3mm in depth, that is satisfactory.

Then, very narrow implant drill (1.25, 1.5 or 2.0) is used to mark the desired position of the implant. This gives us access to the deeper part of the bone.

Convex tip sinus lift osteotomes (TK PLUS, UK) are usually the next instrument, starting with the most narrow one (2.6mm diameter). The idea is to widen the place for the implant. Bone spreading screw-like instruments (Meisinger Split-Control) are also an excellent tool for bone spreading, and they can be used in this stage of procedure. These two types of instruments have shown to be the best for bone expansion and creating a sufficient diameter for implant placement. Alternating between convex tip osteotomes and bone spreading screw-like instruments achieves the best results.

The bone quality and hardness need to be examined intra-operationally due to the variability of bone quality from one case to another. Due to the fact that harder bone breaks in a different pattern than the soft bone, the course of instrument use varies greatly.

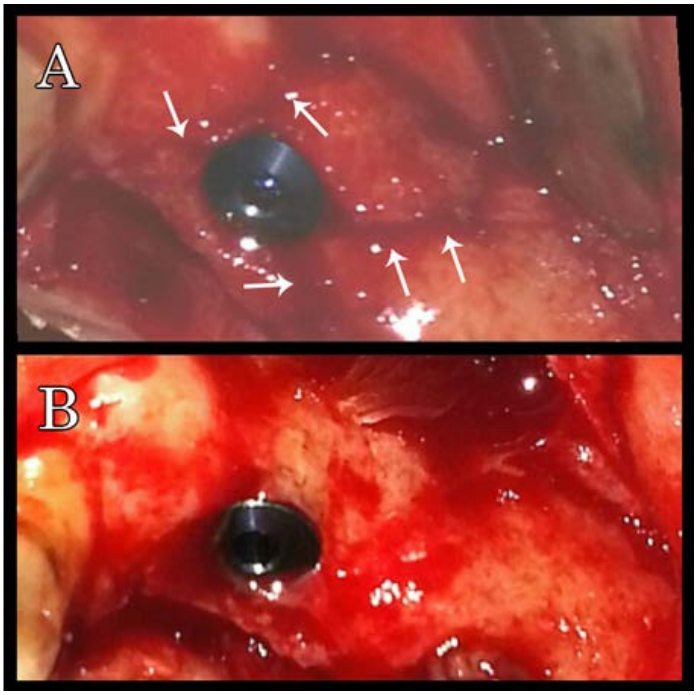

Figure 1: Intra-operational photographs of dental implant in the position of tooth 24 (upper left first premolar) using micro-fracture technique.

A) Dental implant placement, intra-operational photograph. Arrows show four micro-fractures (two towards vestibular and two towards palatal bone plate) smaller than 0.8mm diameter.

B) Three months post-operative photograph. Bone tissue is healed and bone width is more than 70% bigger than pre-operatively. Micro-fractures have completely healed, implant stability is high.

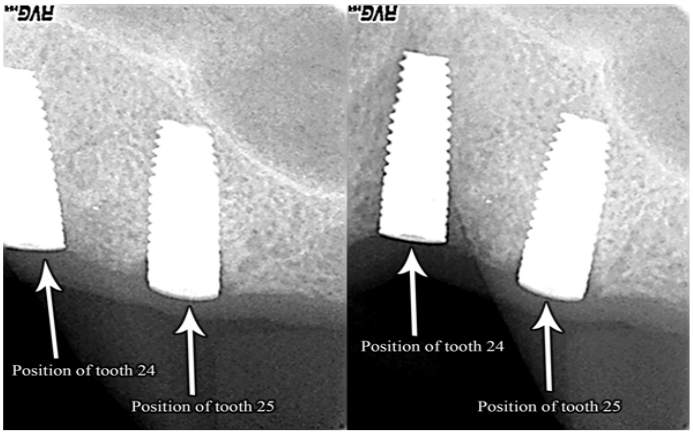

Figure 2 : X-rays of dental implants in the positions of teeth 24 and 25 (upper left first and second premolar). The left implant in both X-rays (position 24) is the same implant in the figure 1, placed using micro-fracture technique. The implant in position 25 was placed without creating micro-fractures. B*oth X rays were taken six months after the surgery.*

In certain cases, a surgical scalpel can be used to set the course for micro-fracture. Just a small cut is sufficient to start a fracture in the desired place. It is recommended to avoid bigger fractures on the vestibular plate, especially on the center line of the implant. It is better to have several small fractures around the implant.

The alveolar bone is usually resorbed the most in the crestal part [2]. It is enough to create micro-fractures in the narrow crestal part, there is no need to go too far towards the apical part of implant. Implant drill will reach the spongious bone, so blood cells will reach the fractured place to start the healing [7]. In cases where CBCT shows no spongious bone at all, even at the depths of 8-10mm, this technique will not be a good choice. Those cases are best dealt with autologous or exogenous bone grafting [2]. However, it is fairly rare to encounter such a situation.

The purpose of the micro-fracture technique is to create a controllable pattern in which the bone fractures, in order to give the bone a chance to heal properly. Micro-fractures also relieve the pressure on the crestal part of the bone. It is important to provide the dental implant with enough healthy surrounding bone after the fracturing. Primary stability of the implant should be a minimum of 10Ncm, but do not exceed 25 Ncm. Stability of all of the fractured bone fragments is crucial to the success of this technique.

That way, a safe and predictable implant healing can be achieved.

This particular procedure was done in 2017, and both the implant and the tooth on it are completely stable. The patient feels no problems at all.

Clinical Case 2

The patient, a 34 year old caucasian female, came for placement of dental implant in canine region (i.e. lower right canine, or tooth 43 in standard ISO tooth notation system) [6]. After clinical examination and tissue palpation around the tooth area, it was concluded that the bone width was not sufficient for placing a dental implant. Canines are important in occlusion and articulation and their position on the angle of the jaw causes them to be exposed to different directions of chewing forces in the mouth [8]. Due to those forces, it was expected that the bone in canine region will be hard bone, type 1 or 2 [9]

A standard flap technique was used to open the site. Most of the bone manipulation was performed using surgical scalpel No.15 (Termofisher, USA) and D-shaped Tatum instrument D1 (Tatum Surgical Inc., USA). In this particular case, it was impossible to avoid fracturing the vestibular bone plate in the mid-line of the implant (photo 2, C and D) due to hardness of the bone. This is advised to avoid whenever possible, but despite that undesirable fracture place, the implant and the bone have healed perfectly.

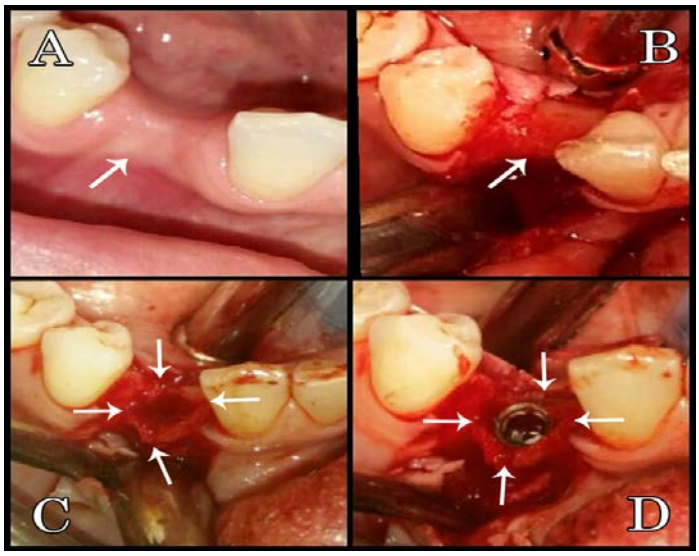

Figure 3: Intra-operational photographs of lower right canine (tooth 43 in standard ISO tooth notation system) [6] implant placement using micro-fracture technique.

- Upper left - Operational site before dental implant placement. Arrow shows the narrow bone and bone resorption on the vestibular side.
- Upper right – Operational site with raised flap. Arrow shows bone loss on the vestibular side.
- Lower left – Finished bone manipulation. Arrows show four microfractures smaller than 0.5 mm in diameter.
- Lower right - 3.75 mm dental implant in the bone.

Follow-up and visual inspection of the operational site in patient two after 4 months showed that the dental implant healed well. The tooth was placed on it with no signs of instability. In other patients, unreported in this study, regular follow-up after the micro-fracture technique showed no post-operative issues.

Discussion

Micro-fracture technique has been performed over 7 years, and this far has shown predictably good outcomes. Both implants and micro-fractures have always seemed to heal well.

Long-term post-operative follow-up indicates that this adapted technique can be used with very high success rate. Correct indication is crucial to achieve the best results.

After the loss of natural tooth, the bone resorption usually affects vestibular part of bone, especially in the crestal part of the alveolar ridge [1]. In some cases, it can be very hard to perform a classic split technique.

Micro-fracture technique can be an alternative to two-stage bone grafting in many of these cases. It is simpler and more cost-effective.

Bone heals from cancellous part, which has good blood supply [9].

The micro-fracture technique consists of creating several smaller micro-fractures while in classic split bone technique, one large gap between vestibular and palatal (or lingual) bone plates is created. In the classic bone split

technique, it is necessary to have cancellous bone between the forementioned bone surfaces [2]. In micro-fracture technique, we can make fractures only in the cortical part of the bone. Cancellous bone will be reached by implant drill, which will allow blood supply to the micro-fractures and facilitate healing [9].

Bone healing can be further facilitated with xenograft mineral material (i. e. Bio-Oss or similar), used alone or mixed with PRF [4]. Different membranes can also be used, just like in any surgical procedure where the operator wishes to separate fast healing soft tissue from slower healing bone tissue [5].

In classic two-stage GBR, new bone formed from xenograft material will be surrounding implant, at least on one side (vestibular or palatal/lingual) [2].

The advantage of micro-fracture technique is that the vestibular and palatal/lingual plates surrounding implant will be formed from the patients' own bone. Another advantage is one-stage procedure, which can reduce cost and discomfort for the patient.

During patient follow-up, it was noticed that micro-fractures up to 1.5 mm wide tend to heal naturally fairly quickly. For larger fractures, the combination of grafting augmentation bone mineral material and PRF clots might be used to speed up recovery by increasing the bio-potential of healing [4].

Conclusion

Micro-fracture technique has been shown to be a technique of choice for narrow alveolar ridges, in cases where classic bone split can not be performed. It can be performed in all bone types. The only exception is type 1 bone with very narrow crestal part, which has no cancelous bone at all, in the depth of 7 mm or more. In those cases, two-stage bone augmentation remains the technique of choice.

Abbreviations

GBR – Guided bone Regeneration

PRF – Platelet-Rich Fibrin

CBCT – Cone Beam Computer Tomography

References

1. High Frequency Acceleration: A New Tool for Alveolar Bone RegenerationM Alikhani, C Sangsuwon, S Alansari, JM Nervina, and CC Teixeira https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6133260/
2. Bone manipulation procedures in dental implants Yuvika Mittal, Govind Jindal, and Sandeep Garg https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4934094/3
3. Elgali, I., Omar, O., Dahlin, C., Thomsen, P. (2017) Guided bone regeneration: materials and biological mechanisms revisited. *European Journal of Oral Science*. 125 (5), pp. 315-337.
4. R. Vijayalakshmi, C. S. Rajmohan, D. Deepalakshmi, and G. Sivakami https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3357016/
5. Rozalia Dimitriou, George I Mataliotakis, Giorgio Maria Calori, and Peter V Giannoudis The role of barrier membranes for guided bone regeneration and restoration of large bone defects: current experimental and clinical evidence - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3423057/
6. ISO System by the World Health Organization https://en.wikipedia.org/wiki/Dental_notation#ISO_System_by_the_World_Health_Organization
7. Fractures Michael C. Hall https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1921556/

8. Biomechanics of the Human Canine Pillar Basedon its Geometry Using Finite Element Analysis Alexandre Rodrigues Freire*; Felippe Bevilacqua Prado*; Ana Cláudia Rossi*;Pedro Yoshito Noritomi**; Francisco Haiter Neto*** & Paulo Henrique Ferreira Caria* http://www.intjmorphol.com/wpcontent/uploads/2015/06/art_36_321.pdf
9. Clinical and Radiological Classification of the Jawbone Anatomy in Endosseous Dental Implant Treatment Gintaras Juodzbalys and Marius Kubilius https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3886111/