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CLINICAL REPORT

Pterygomaxillary Implants: A Graftless Solution to Deficient Maxillary Bone

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Abstract Edentulism is one of the common dental problems in the aging population. Implant therapy has emerged as one the valid and effective solutions to this problem. However in the maxilla, posterior part presents with several anatomic obstacles in the form of bone quality, quantity, size of maxillary antrum and poor accessibility. There are various options like sinus lift with graft and pterygomaxillary implant options available. Option like ptergomaxillary implants requires lot of skill of technic sensitivity and skill of the surgeon and also is proven to be statistically superior. Case reports of pterygomaxillary implants for both partially edentulous and fully edentulous conditions are hereby described in the article.

Keywords Pterygo-maxillary implants · Graftless solutions · Edentulism

Introduction

An edentulous situation in the posterior maxilla, poses a challenge to the restorative dentist. The reason is largely due to anatomic factors like bone quality often type III or IV quality bone according to Lekholm and Zarb [1], quantity, location of the antrum and poor accessibility in the area [2, 3]. The solutions proposed for rehabilitating such regions comprise sinus lifting with bone grafts [4–7], the use of short implant lengths [8], increased implant diameters [9, 10], and the placement of implants in anatomical buttresses [11].

The sinus lift procedure with bone grafting is one of the solutions that can be executed to solve this problem. This procedure has gained popularity over the recent years but it has its own drawbacks like requiring a double surgical site with consequent increase in patient morbidity. However, with this procedure, there remains the risk of perforation of the sinus membrane as well as a possibility of resorption of the graft around the implant. Apart from this, the procedure may be complicated in patients with chronic maxillary sinusitis. The vascularity of the graft is also questionable if minimum bone height is not present.

The anatomic buttress of the maxilla is represented by two anterior buttresses (frontomaxillary and frontozygomatic) and a posterior buttress (pterygomaxillary) [11]. Placement of implants in the pterygomaxillary region provides posterior bone support without sinus augmentation or supplemental grafts. Because of limited accessibility, placement of these implants is more technically demanding than placing implants anterior to the antrum. However, there are no greater risks associated with implant placement in this area [2]. The following cases are examples of patients indicated for pterygomaxillary implants in partially edentulous and completely edentulous situations.

Case Report

Case 1 Partially Edentulous Situation

A 65 year old female patient reported with a complaint of extracted maxillary 24, 25, 26 and 27 due to dental caries about 8 years back (Figs. 1, 2). On intraoral examination,

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Fig. 1 65 Year female patient with partially edentulous upper and lower arches

Fig. 2 Intra-oral view showing edentulous posterior left maxillary and posterior right mandibular arches

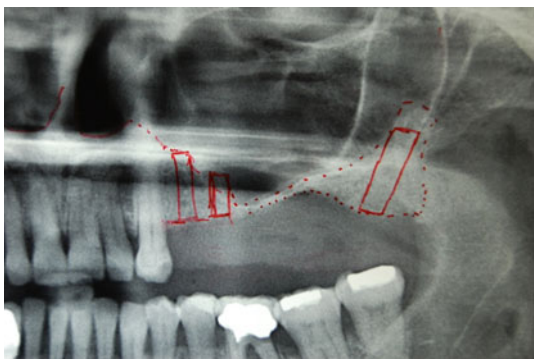

Fig. 3 Pre-operative OPG showing minimal bone in region of maxillary sinus and adequate bone in the pterygomaxillary region. Also shown is the planned placement of the implants

ridges were well formed and the interarch space was adequate. Radiographic picture (Fig. 3) and the computed tomography (CT) demonstrated very little bone to be present in the maxillary sinus region. Considering the amount of residual bone, it was decided that the pterygoid implants were the best alternative.

CT scans were carefully studied for the thickness and height of bone in the tuberosity region. The mouth opening

Fig. 4 Clinical photograph showing implants in situ

Fig. 5 Post-operative OPG showing 3 implants in 24, 25 and left pterygomaxillary region

was assessed and found to be adequate for placing implants in the tuberosity region. Routine blood investigations were done and fitness obtained for surgical procedure.

Three implants were placed in the regions of 24, 25 and the tuberosity region. The dimensions of the implants were 3.75 × 13 mm, 4–2 × 10 mm and 5 × 13 mm respectively (Figs. 4, 5). After six months of healing the implants were exposed and healing collars were placed for 3 weeks after which the impressions were made for a screw retained metal–ceramic fixed prosthesis (Figs. 6, 7). The patient was then rehabilitated with screw retained metal–ceramic fixed prosthesis.

Case 2 Completely Edentulous Situation

A 74 year old male patient (Fig. 8) presented with multiple failed implants in the maxillary arch with one loose implant in the maxillary sinus. The implants were placed about a year back and the prosthesis was broken and the implants had started to become loose. Patient was keen on having a fixed prosthesis.

On detailed examination of the CT Scan i.e. Dentoscan, there appeared to be adequate width of available bone in the anterior region of the maxilla but inadequate bone in the maxillary sinus region. Also in the left maxillary sinus,

Fig. 6 Fabricated metal–ceramic prosthesis

Fig. 7 Metal–ceramic prosthesis in situ

Fig. 8 75 Year male with completely edentulous maxillary arch

there appeared to be an implant that was loose and lying at the posterior aspect of the sinus (Fig. 9).

A Caldwell luc approach was done to retrieve the implant from the sinus. It was found that the sinus was infected and the sinus lavage had to be done. The sinus lift procedure and implants in this region were avoided due to the infection. Hence, it was decided that pterygoid implants were the best choice. After a week of antral lavage 8 Nobel replace select tapered implants were placed in the maxilla (Figs. 10, 11). A screwed in metal–ceramic prosthesis was then fabricated (Fig. 12) and placed.

Fig. 9 Pre-operative OPG showing loose maxillary anterior implants and one displaced implant in left maxillary sinus. Also notable is the inadequate bone bilaterally in the maxillary sinus region

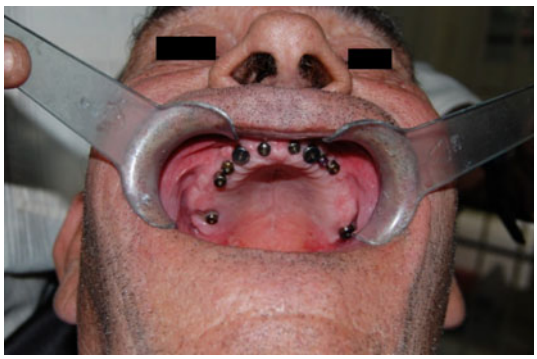

Fig. 10 8 Noble replace select tapered implants and 2 pterygomaxillary implants in situ

Fig. 11 Post-operative OPG showing implant placement. Bilaterally the pterygomaxillary implants are housed axially in dense bone

Discussion

The posterior maxilla has been described as the most difficult and problematic intraoral area confronting the implant practitioner, requiring a maximum of ingenuity for

Fig. 12 Final metal–ceramic prosthesis in situ

the achievement of successful results [12, 13]. Solutions like sinus lifts often involve double site procedures and added bone grafting that involves a longer healing period, possibility of perforation of the sinus membrane along with the risk of infection [14].

In such cases, when patients have severely atrophic maxillas and are unwilling or unable to undergo extensive bone grafting, Zygoma fixtures (Nobel Biocare, Göteborg, Sweden) may provide an alternative. Ranging in length from 30 to 52.5 mm, Zygoma fixtures are anchored in two different types of bone. The head of the fixture normally emerges in a slightly palatal position in the second premolar or first molar area of the maxilla, while the other end of the fixture engages the very dense mid facial zygomatic bone. The body of the fixture thus traverses the posterior portion of the maxillary sinus, ideally avoiding penetration of the sinus mucosa. Initial sino scopic studies of patients treated with Zygoma fixtures indicate that the presence of a titanium foreign material inside the sinus cavity does not appear to increase the risk of inflammatory reactions in the nasal and maxillary sinus mucosa. Because of the greatly increased length of the fixtures and the limited bone support commonly found in the alveolar crest, Zygoma fixtures have an increased tendency to bend under horizontal loads jeopardizing the long-term stability of implant supported restorations. Placement of the Zygoma fixtures is demanding and difficult, requiring considerable surgical expertise. On the other hand, this approach offers patients and implant practitioners a number of advantages, including shorter treatment and hospitalization times than that required by most grafting procedures, as well as reduced pain and risk of morbidity. The ability to use fewer implants may also result in lower treatment cost [14].

Several articles have assigned various labels to the posteriorly placed maxillary implant. Implants in this region have been described as tuberosity implants [15–17] pterygoid plate implants [18], and pterygomaxillary implants [19. The varied terminology arises as a result of the various anatomic structures that may be engaged in the placement of implants in this region. The precise structures offering potential support for implant placement are the tuberosity of the maxillary bone, the pyramidal process of the palatine bone, and the pterygoid process of the sphenoid bone [20].

The tuberosity is the posterior convexity of the maxillary alveolar ridge. Its medial and posterior boundary is the pyramidal process. The pyramidal process of the palatine bone and the anterior surface of the pterygoid process of the sphenoid bone are located behind and slightly medial to the tuberosity [21]. This process binds to the anterior surface of the pterygoid plates of the sphenoid bone and is interposed between the inferior end of the pterygoid plates and the maxillary tuberosity. This junction of the palatine bone and pterygoid plates forms a narrow column of dense bone, referred to as the pterygoid pillar, into which the apical portion of an implant can be fixed. According to Reiser [22], Depending on the angle of placement and length of the posterior implant, four apical anatomic bone engagements are possible and can be classified as follows:

1. Tuberosity
2. Tuberosity/pterygoid process
3. Tuberosity/pyramidal process
4. Tuberosity/pyramidal process/pterygoid process

As far as the treatment planning is concerned, it is essential to execute treatment planning in reverse; that is, the desired reconstruction is selected by the treatment team, and the steps necessary to reach this goal are simulated in reverse order. Preoperative evaluation is designed to confirm the appropriateness of treatment with osseointegrated implants, select the proper implant site, and identify all problems that require correction before the implant is placed. Among the factors to be considered are the anatomy and condition of the potential site and its relation to other structures; the position, quantity, and quality of the bone; the relation of the ridge to the adjacent and opposing teeth; and the quality and dimensions of the soft tissues. The occlusal relationships and anterior esthetic requirements also must be assessed. The dimensions, morphology, and character of bone at the proposed site must be thoroughly evaluated in three dimensions. Conventional radiographs are inadequate for assessing hard tissue quality, but CT can depict the quality and quantity of bone and the distance between the cortical plates. A radiopaque marker placed on a stent or provisional acrylic resin restoration at the level of the edentulous ridge will help indicate the implantation site [15].

Because of the anatomic factors and some biomechanical factors [23], one would expect the success rate for implants placed into the posterior maxilla to be lower than that for other locations. However, Balshi [16] reported favorable 3 year results for 51 implants placed in the

pterygomaxillary region. He later reported on a study of implants that were placed in the pterygomaxillary region and supported fixed prostheses in partially edentulous patients. Bahat [15] reported on 72 implants placed in the tuberosity region, which achieved a 93 % survival rate over an average loading time of 1.7 years. Tulasne [21] addressed the use of 13 implants placed in the pterygomaxillary region in function for 12 months. In 1994, Khayat and Nader [17] reported on implants in the pterygoid position followed over a 4-year period. Also in 1994, Graves [18] described 43 implants in the pterygoid plate area. Balshi analyzed 356 pterygomaxillary implants by in function from 6 months to 9.5 years with cumulative survival rate of 88.2 %.

Conclusion

Graftless solutions for rehabilitation of atrophic jaws are coming in the limelight of late because of the uncertainties associated with bone grafting procedures. Limitations of bone grafting lies in the morbidity it can bring about and also if bone grafting has failed once it leaves the clinician with little options but to employ a graftless solution by utilising whatever bone that is present. Pterygo maxillary implants work well when placed aptly, as these are placed in dense bone.

The main disadvantage with this procedure is that the site of implant placement is precarious as the anatomy of this site is poorly described. Mouth opening should be adequate to accommodate the handpiece and the drill. Restoration of the pterygomaxillary implants is a challenge to the prosthodontist as the site is inaccessible and all components should be handled with utmost care as there is a high possibility of aspiration of the components. Though the results are promising, case selection is very important and a thorough understanding of the pitfalls of the procedure should be borne in mind.

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