Introduction

Planning for replacement of teeth in the posterior maxilla using implant restorations is determined by the residual subantral bone volume and quality. With both loss there is a loss of the available vertical bone height, due to a loss of the associated alveolar bone and on-implant gingival architecture of the maxillary sinus. In a partially dentate patient, there are several clinical options available for tooth replacement, including acceptance of a shortened dental arch, providing a removable partial denture or conventional fixed bridgework, use of short implants, or sinus floor elevation to facilitate placement of longer implants. With very large bone defects further clinical options are available, including the use of zygomatic implants.

Sinus grafting

There are two common techniques for sinus grafting. The crestal approach uses pilo-drills to create an osteotomy to within 2mm of the sinus floor, which is then up-fractured using an osteotome. Bone grafting biomaterials are then placed under the tented-up sinus floor. This procedure needs good surgical control and an excellent awareness of the relevant anatomy as there is limited vision of the surgical field. The lateral window approach involves the creation of a window in the lateral wall of the sinus using either a bur or piezoelectric tip. Positioning of the lateral window needs to avoid the maxillary sinus blood supply. The window can be either removed entirely or pushed up, if as a trapdoor, to form a new floor of the sinus, and the sinus cavity packed with graft material of various types. A xenograft collagen membrane can then be used to cover the lateral window.

Sinus grafting is associated with a higher risk of post-operative complications. These include bleeding, perforation of the sinus membrane and infection of the grafted sinus. With both grafting techniques there is a risk of perforation of the sinus lining, although this is more difficult to assess with a crestal approach. Perforation of the membrane is associated with twice the risk of infection. A recent meta-analysis demonstrated no significant difference between the survival rates for implants dependent on whether autogenous bone or xenograft biomaterials (Bio-oss) were used to graft the maxillary sinus floor. However there is some evidence that the overall survival of implants placed into grafted maxillary sinuses may be lower than that in native bone. Pjetursson 2008 found a 90.1% survival of implants placed into mature sinus graft material 3 years, although a subgroup analysis of rough implants had a 98.3% survival.

Short implants

The European Association of Dental Implantologists Consensus 2016 defines short implants as less than or equal to 10mm in length, with ultra-short implants defined as less than 7mm in length. However, this definition is not universally accepted, with some systematic reviews continuing to define short implants as less than 10mm in length. Short implants are growing in popularity for the restoration of the posterior maxilla and mandible where there is limited vertical bone height available above local anatomical structures such as the maxillary sinus and the inferior alveolar nerve. Studies, systematic reviews and meta-analyses comparing the survival of short implants to standard lengths have failed to find a significant difference between them. Short implants have the added advantage that they have lower rates of surgical complications associated with them when compared with sinus grafting.

Short implants tend to have a higher crestal/implant ratio, although there is evidence that this is not related to lower success rates of short implants. There is evidence that surface texture (machined versus rough) plays a primary role in the performance of implants of less than 7mm long.

Case Report

Mr C presented to the Leeds Dental Institute in August 2015 with functional and aesthetic concerns related to hypodontia. He was experiencing problems chewing due to loss of some posterior teeth and was unhappy with the position of his anterior teeth. He had previously had some orthodontic treatment, but had been unable to tolerate a fixed appliance. He was medically well, and a non-smoker. He had a low cariogenic and erosive diet, wore a nightguard for nocturnal bruxism, and a sportsguard when participating in intramural competitions.

Clinically, there was fair plaque control present, with calculus deposits on lower incisors and a BOP of 0/3/1/2/2. There was mild attritive toothwear anteriorly. The ULC was retained metal to the UL3 and within the arch, demonstrating grade 1 mobility and discoulouration. The LRD was retained, and was discouloured and grade 1 mobile. Loss of the upper teeth had resulted in 8.5mm space in the UR4 region and 4.5mm space in the UL4 region.

Pre-operative clinical photos demonstrating retained deciduous teeth and missing upper premolars

Clinical photos taken in lateral view, showing that, in this case, the ULE space has been restored with a metal-ceramic implant crown.

Residual subantral bone

Clinical decision

>6mm

Short or standard length implants

5-6mm

Clinical decision based on bone quality and existing risk factors for marginal bone loss (e.g. smoking, current periodontitis). Sinus grafting recommended in type IV bone and with higher risk factors for marginal bone loss.

<5mm

Sinus grafting

Discussion

Short implants or sinus grafting are both predictable ways of restoring the posterior maxillary region where there is limited subantral bone volume. A Cochrane review was unable to find a significant difference between prostheses or implant failure in patients treated with short implants or sinus elevation, although there are more complications associated with sinus elevation. This is echoed in a more recent meta-analysis, which also notes that short implants may be associated with more affordable and quicker treatment outcomes. As there are similar expected outcomes with both treatment modalities, it is therefore important to consider both patient factors and surgeon preferences in the final clinical decision.

Primary stability may be more challenging to gain for short implants, due to their lower bone/implant contact area. Particularly where there is type IV bone, it may be more advisable to graft the maxillary sinus, as short implants have poorer outcomes in type IV bone.

A decision tree for choosing between short implants or sinus grafting has been suggested by Neave and Ramaunz in their narrative review from 2014. This provides a good clinical guide for clinical decision-making in the posterior maxilla.

Conclusions

Both short implants and sinus grafting are associated with similar survival rates, but the long-term evidence for short implants is still limited at present. The decision between the treatment modalities depends on the residual bone height, patient factors and surgeon’s preferences.

References