Implant placement in the maxillary tuberosity: the Summers’ technique performed with modified osteotomes


The maxillary tuberosity region is becoming increasingly involved in prosthodontic surgery as part of a comprehensive implant treatment planning. The lower success rates in osteointegrated implant placements seen in the posterior regions of the upper maxilla as compared to the anterior regions of the jaws, most often come from bone quality types and the presence of the maxillary sinus. In order to overcome these limitations and obtain a successful result in such a demanding area, several authors suggest that long implants (15.0 to 20.0 mm long) should be placed in the maxillary tuberosity region as an alternative to sinus floor elevation. The challenges frequently associated with the surgical placement of “maxillary tuberosity implants” (MTI), can be reduced through a “Ridge Expansion Osteotomy” (REO) procedure as described by Summers (1994). This indeed improves the recipient bed bone quality and causes no bone overheating. In order to improve this technique performed for MTI, in co-operation with Ing. Albanese G, authors have developed different prototypes of modified osteotomes. A case report using these new instruments is presented. Clinical and radiographic evaluations are obtained.

The lower success rates of implants placed in the posterior areas of the upper as compared to the lower jaw are in most cases the consequence of a poorer bone quality, this being biologically less suitable to promote implant osseointegration (Jaffin & Berman 1991). Besides, the maxillary sinus, encroaching upon the molar area where occlusal loads are highest, provides a significant anatomical limiting factor. In order to avoid these histological and anatomical obstacles, several authors (Scortecchi 1991; Tulasne 1992; Bahat 1992; Khayat & Nader 1994; Summers 1994; Benzing et al. 1995; Balshi et al. 1995; Venturelli 1996) suggested the placement of long implants in the maxillary tuberosity as an alternative to the sinus floor elevation. Implant placement in the tuberosity area does not only allow to bypass the sinus-related anatomical constraints, but does also provide distally to the first molar region an addition anchorage that can successfully withstand prosthetic loads (Setz et al. 1989; Tulasne 1992; Khayat & Nader 1994; Balshi et al. 1995; Benzing et al. 1995).

Surgical placement of maxillary tuberosity implants (MTI) can be performed following two different surgical procedures: the first is performed by twist drills, the second requires the use of cylindrical osteotomes according to the “Ridge Expansion Osteotomy” (REO) procedure as described by Summers (1994).

From a surgical point of view the osteotome technique is safer. The use of blunt tools instead of sharp drills minimizes the danger of injuring the palatine artery and nerve. As a result, haemorrhages are almost nil.

Materials

In order to improve the access to this challenging area, the maxillary tuberosity, modified anatomical osteotomes were designed by the authors in co-op-
Nocini et al.

Fig. 1. Summers' osteotomes (above). The modified osteotomes (centre and below).

Fig. 2. Technical drawings of the modified osteotome.

Fig. 3. The new tips.

Fig. 4. Dental scan showing the maxillary tuberosity: left side (above), right side (below).

Operation with Ing. Albanese G. The used modified osteotomes (Fig. 1) are made of stainless steel (AISI 316). They are a compound of two parts: the double folds shaft, and the tips. The shaft presents a first clockwise fold of 30° in respect of the longitudinal axis, followed by a second opposite fold of 10° from the new axis (Fig. 2). Thanks to these two folds the tips are displaced about 1.0 cm away from the main axis, and they present a final clockwise inclination of 20°. The tips are in two different forms: those of 1.8, 2.0, 2.9, 3.2, 3.8 mm diameters have a conical shape with a cutting edge; those of 3.4, 4.2, 5.0 mm diameters have a cylindrical shape with a bevelling edge (Fig. 3). Both the shaft and the tips present a knurling in order to obtain best handling.

For implant rehabilitation, root-form press-fit cylindrical implants made of titanium coated with HA-plasma-sprayed have been used.

For the bilateral implant placement in the tuberosity we followed the REO procedure, using these modified osteotomes.

Case report

A male patient of 50 years old, presented total tooth loss of upper jaw.

Radiographic evaluations showed a sufficient height and thickness of the alveolar process to place 6 implants into the pre-maxilla.

In order to have a complete upper jaw rehabilitation through a circular fixed prosthesis without long cantilivers, we proposed to the patient a bilateral sinus floor elevation. Because of the patient's refusal to undergo this surgery, it was decided to perform a bilateral MTI placement in order to obtain a spread-out implant distribution. CT-scan, mainly cross-sectional reconstruction (Denta-Scan), was used in order to evaluate the size and shape of maxillary tuberosity before surgery (Fig. 4).

The total upper jaw implant rehabilitation was performed in conscious sedation, anaesthetizing the intra-orbital, the major palatine, the posterior superior alveolar and the nose-palating nerves.

A full arch crestal gingival incision was performed in order to improve the surgical access, three releasing incisions were done in the fornix (Fig. 5): one at the mid line and two extended as
Implant placement in the maxillary tuberosity

Distal as possible over the tuberosity apex into its descending slope. An extensive full-thickness flap was then elevated to visually assess the shape, quality and porosity of the maxillary bone. The ideal position of implants was identified using a surgical stent.

The anterior part of the maxilla was rehabilitated placing 6 implants, performing the REO technique through straight osteotomes. By changing the osteotome angulation, bone powder was collected from the surrounding area and compacted against the osteotomy walls and bottom.

Referring to the MTI, a 20–30° anteriorly angulated and palatally oriented groove was shaped into the maxillary tuberosity (Fig. 6). The pre-angulated osteotomes with gradually increasing diameters of the tip were used in succession. Special circulars knurling of the tips, were used to reveal how deeply the implant had been advanced.

Having reached the ideal width and depth of the osteotomy, a press-fit cylindrical implant was introduced bilaterally (Fig. 7).

Radiographic evaluation was obtained pre and post implant placement (Fig. 8).

Discussion

It appears that the tuberosity area can also be used for implant placement. Actually, if an optimized surgical protocol is adopted, the success rate of MTIs is comparable to other areas of the oral cavity. The current trend is to move away from mucosa-supported mobile dentures as well...
as from fixed bridges with long distal cantilevers (Benzing et al. 1995; White 1993). Consequently, the maxillary tuberosity area is more and more involved in implant treatment planning, especially when more complicated surgeries (sinus floor elevation) are rejected by patients on the grounds of their high cost, longer healing time and increased risk of intra-operative complications (Regev et al. 1995).

The ridge expansion osteotomy (REO), in MTI placement, appears to be a quick procedure, requires no bone removal and, indeed, being an expansive technique, it allows cortical bone compaction and latero-apical consolidation of bone trabeculae. The compactedness achieved with REO is certainly desirable in the tuberosity loose bone (type IV).

The "corticalization" of implant-future site combined with the development of more-bioactive implant surface (De Santis et al. 1996) (see HA-plasma sprayed coating or blasted surfaces (Fig. 9)) reduce the need of bi-cortical anchorage into the pterygoid processus thus reducing the risk of tuber fracture.

Avoiding the use of drills, blunt osteotomes minimize the surgical complications, mainly like the haemorrhage from the palatine artery (Fernandez & Fernandez 1997).

Summers osteotomes, because of their straight shape, are really efficacious in the pre-maxilla, but are difficult to deal with, in the posterior maxilla. When the upper second–third molar and the tuber are involved, it is hard to keep the right inclination of the Summers’ osteotomes.

Lower jaw teeth, inferior lip and chin often hamper instruments orientation $20–30^\circ$ back. Frequently lip tissues are crushed on the mandible in order to have the desired access (Fig. 10).

The new osteotomes present two advantages. As the first, the presence of a double fold displaces the shaft of about 1.0 cm from the working site: this makes the instrument able to follow the anatomy of the oral cavity reducing the dangers of tissues crush. We clearly noticed less pressure on loose tissues of the inferior lip and less tension on the labial commissura (Fig. 11).

As the second, the osteotomes predetermined inclination allows to obtain the right angle of $20^\circ-30^\circ$ for the implant receiving site into the tuber, simply keeping the instrument grip orthogonal to the maxillary bone crest and so avoiding improper inclination.

In addition, the easy tuberosity access and the perfect visibility of the tuber site and a good instrument manoeuvrability allow to reduce time of surgery, increasing the compliance for the patient and the surgeon towards this technique.
Implant placement in the maxillary tuberosity


要旨
上頜結節部は総合的なインプラント治療計画の一環として補綴治療前の手術の対象となることが多くなってきている。上頜臼歯部での骨性総合インプラントの成功率は、前歯部で比べて低いが、これはほとんどの場合、骨質のタイプ及び上顎洞の存在に起因している。このような制約を克服し、条件の厳しい同部位で成功を収めるために、数人の研究者は上顎洞挙上術の代わりに上顎結節部に長い（長さ15.0 mm 〜20.0 mm）インプラントを埋入することを提唱している。

上顎結節部のインプラント（MTI）埋入にまつわる困難さは、Summersが提唱する（1994）頚堤拡大骨切削術（R E O）によって軽減することが可能です。これは受給側の骨質を改善し、骨の過剰な加熱を起こさない。

MTIのための本テクニックを改良するため、著者等はIng.Albanese G と協力し、改良型骨刀の各種試作品を開発した。これらの新しいインスツルメントを用いた症例報告を供覧する。臨床的及び放射線像による評価も行った。

References
Nocini et al.


