Modern implants from a different angle

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Background

With the success of dental implants, the profession of dentistry has moved into applying innovative ideas that have decreased treatment time and amplified the quality of patient’s lives. While integrating into modern dentistry, implant treatment has shifted direction from being surgically driven to prosthetically driven. Amongst other developments in improving all aspect of implant dentistry, angled implants were first introduced in the early 1990’s and since then there has been ample research conducted to study and assess their support. (Figure 1)

Implants were originally tilted in a bodily fashion to bypass certain anatomical structures or otherwise hindered clinicians from placing them in areas such as maxillary sinus, inferior alveolar nerve canal, the mental foramen, mandibular lingual concavities and maxillary buccal concavities. Procedures such as nerve repositioning, various grafting procedures, distraction osteogenesis, ridge splitting and many more not only lengthened treatment time, but also increased patient morbidity during implant rehabilitation cases. In addition to bypassing the anatomical constraints, the tilting of posterior implants in a distal manner results in an increase in the implant’s contact with bone, thereby allowing better load distribution and contributing to the cantilever effect associated with tilted implants. Angled implants became an effective and safe alternative to major augmentation procedures such as maxillary sinus grafting procedures and ridge augmentation procedures.

Initially there were negative speculations regarding the hard and soft tissue response around tilted implants as opposed to axially straight implants. However various in vitro and in vivo studies have proven no apparent long-term detrimental effects associated with angled and straight implants. Kreekman et al in 2000 followed up forty-seven consecutive patients with tilted implants for forty months and showed no significant difference between tilted and non-tilted implants. A comparative 3D finite element stress analysis conducted by Cases et al in 2008 showed no indication that angled implants create stress-induced problems compared to straight implants. A meta-analysis performed by Mericskay al in 2012 evaluated the outcomes of upright and tilted implants supporting full arch bridgework. The immediate rehabilitation of edentulous maxillae, after at least 1 year of healing, No significant mean difference between tilted and upright implants was found with regards to bone loss. Rosén et al in 2015 retrospectively evaluated the surgical effect of tilted implants in the severely resorbed edentulous maxilla as opposed to bone grafting and conventional prosthodontics to restore the posterior maxilla. In a ten-year study patients with tilted implants and conventional prosthetic alternatives to the more demanding grafting techniques.

Angled abutments

Furthermore while angled implants improved load distribution, reduced augmentation procedures, lessened cost, treatment time and eliminated cantilevers in many cases they did necessitate the use of angled abutments to achieve a parallel path for the draw of the final prosthetic crown. Custom or prefabricated abutments were necessary to redirect the screw access holes in a common path of insertion to aid in the fabrication and installation of the final prosthesis. In addition these abutments were also used to redirect the screw access hole in the lingual direction to aid with esthetics of the final restoration. In cases of severe angulations the patient is limited to the use of cemented restorations with the use of custom made abutments (Figure 2).

Although these abutments are widely used today, they do present certain disadvantages that warrant mention. Firstly the connecting surfaces of custom made abutments may have evacuation problems between angled and straight abutments. Kreekman et al in 2000 followed up forty-seven consecutive patients with tilted implants for forty months and showed no significant difference between tilted and non-tilted implants. A comparative 3D finite element stress analysis conducted by Cases et al in 2008 showed no indication that angled implants create stress-induced problems compared to straight implants. A meta-analysis performed by Mericskay al in 2012 evaluated the outcomes of upright and tilted implants supporting full arch bridgework. The immediate rehabilitation of edentulous maxillae, after at least 1 year of healing, No significant mean difference between tilted and upright implants was found with regards to bone loss. Rosén et al in 2015 retrospectively evaluated the surgical effect of tilted implants in the severely resorbed edentulous maxilla as opposed to bone grafting and conventional prosthodontics to restore the posterior maxilla. In a ten-year study patients with tilted implants and conventional prosthetic procedures. Proceedings such as nerve repositioning, various grafting procedures, distraction osteogenesis, ridge splitting and many more not only lengthened treatment time, but also increased patient morbidity during implant rehabilitation cases. In addition to bypassing the anatomical constraints, the tilting of posterior implants in a distal manner results in an increase in the implant’s contact with bone, thereby allowing better load distribution and contributing to the cantilever effect associated with tilted implants. Angled implants became an effective and safe alternative to major augmentation procedures such as maxillary sinus grafting procedures and ridge augmentation procedures. Initially there were negative speculations regarding the hard and soft tissue response around tilted implants as opposed to axially straight implants. However various in vitro and in vivo studies have proven no apparent long-term detrimental effects associated with angled and straight implants. Kreekman et al in 2000 followed up forty-seven consecutive patients with tilted implants for forty months and showed no significant difference between tilted and non-tilted implants. A comparative 3D finite element stress analysis conducted by Cases et al in 2008 showed no indication that angled implants create stress-induced problems compared to straight implants. A meta-analysis performed by Mericskay al in 2012 evaluated the outcomes of upright and tilted implants supporting full arch bridgework. The immediate rehabilitation of edentulous maxillae, after at least 1 year of healing, No significant mean difference between tilted and upright implants was found with regards to bone loss. Rosén et al in 2015 retrospectively evaluated the surgical effect of tilted implants in the severely resorbed edentulous maxilla as opposed to bone grafting and conventional prosthodontics to restore the posterior maxilla. In a ten-year study patients with tilted implants and conventional prosthetic procedures.

Figure 1. Tilting of Implants in the early 1990’s

Figure 2. Angled abutments

Anterior Maxilla

Implants in the esthetic area has been a popular topic in the recent years due to the catastrophic failures associated with implants in the esthetic region. The difficulty that arises with implants in the esthetic area is related to anatomic limitations and the higher restorative properties of the buccal plate. The anatomic limitation is the esthetic area. The anterior maxilla is associated with the pre maxillary region. The anatomic limitations of the anterior maxilla often require either an angled implant or adjunctive grafting procedures. The use of Co-Axis implants allows the operator to place an implant in the extraction socket of an anterior maxillary tooth without pressure on the buccal plate and simultaneously avoid buccal plate perforations. The placement of an implant close to the buccal plate will lead to implant thread failure after initial healing, not to mention the inevitable use of custom made abutments and cemented restoration to correct the severe facial angulations. Consequently by avoiding the use of angled or customized abutments the inflammatory response due to the micro gap / cement that may ultimately lead to crestal bone loss over time is eliminated. Lastly, facial inclination of an implant makes the facial surface of the connecting abutment thinner than usual and hence allowing for a minimal 2mm of buccal bone that will ensure the stability and firmness of the gingival position in the esthetic area. (Figure 4)

Figure 4. Co-Axis Implant Placement in the anterior maxilla, b: X-ray of a 12 degree Co-Axis Implant

Figure 3. Co-Axis Implants in three different connection

Figure 5. All-on-4 Restoration using Co-Axis Implants

Deciding on the Angle

This tapered body implant is available in 12°, 24° and 36° degree built in angle, ranging in 4, 5, 6 mm diameter and 8.5mm to 14mm in length. It is currently available in the external hex, Tri-nex and internal octagon connections. In extreme cases for even higher angle correction, the Co-Axis implant can be combined with a 17° or even the 50° angled abutment. With various angulations available one can make a decision of the angle needed by the use of angled direction indicators that may be used to orientate and assess the 3-D position of the desired access hole within the surgical guide(Figure 6). The angled directional indicator is inserted into the osteotomy and the prosthetic axis is checked regarding the access hole position for screw retention as well as for parallelism with other implant fixtures. When the orientation is con-
firmed, then the site is enlarged to appropriate implant diameter & length and the implant with the appropriate built in angulation is inserted(Figure7). The angle correction of the implant is therefore at a sub-crestal level and prosthetic space is not utilized by angulated abutments.

**Conclusion**

Today more clinicians are advocating the use of angled implants. This leads to less grafting procedures that not only minimizes the overall treatment time, but also reduces the cost and diminishes the patient's morbidity associated with grafting procedures. Co-Axis implants also allow early or immediate loading protocols that would otherwise not be possible with grafting procedures. Therefore, the use of native bone, the avoidance of expensive angulated abutments, decreased patient morbidity, reduced cost, benefits of immediate loading, likelihood of bone retained restorations, and elimination of long cantilevers are all advantages of using Co-Axis implants.

**References**


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**About the Authors**

**Costa Nicolopoulos DDS, FFD (SA) MFDS**

Oral & Maxillofacial Surgeon
Dr. Costa BDS qualified as a dentist in 1984 receiving his dental degree cum laude from the University of Witwatersrand, Johannesburg, South Africa. He graduated top of this class with rank order No.1 and received numerous awards including the Gold Medal of the Dental Association of South Africa for the most outstanding graduate. In 1986 he completed his 4 year full time postgraduate Maxillo-Facial & Oral Surgery training at University of Witwatersrand, South Africa and was awarded FFD (SA) MFDS. Since 1999 he is in full time specialist Maxillo-Facial & Oral Surgery private practice concentrating on immediate loading rehabilitation of dental implants. To date he has placed over 50,000 dental implants. He has also presented as a key lecturer at numerous international implant congresses.

**Dr. Safa Tahmasebi D.D.S, MS, Cert, Prosthodontist (USA)**

Dr. Safa Tahmasebi Completed his Bachelors degree in Biology and a minor in Biochemistry at Saint John’s University. Queens New York in 2004 with a full scholarship based on academic performance. In 2005 he joined State University of New York at Buffalo School of Dental Medicine where he attained his Doctor of Dental Surgery and qualified as a Dentist in 2006. He joined the Albert Einstein Medical hospital of Montefiore in Bronx New York where he completed one-year hospital dentistry fellowship. In 2015 he completed three and half year full time training in prosthodontics and surgical training with a masters degree in prosthodontics at the West Virginia University School of dentistry. During this time He was an adjunct clinical instructor to the undergraduate programs at the WVU University. In 2015 he joined the SameDay Dental implants Bränemark Osseointegration Center (BOC) Dubai as a full time prosthodontist specializing in full mouth rehabilitation, immediate loading and Smile reconstruction.
Sinus lift with simultaneous implant placement

Piezosurgery offers the patient a gentle treatment with less complications and time saving benefits.

By Dr. Peter Hentschel

Osseointegration has been paid notice for a long time to regain maxillary function and for aesthetic reasons. Implant placement in the maxilla is often limited due to missing height of the alveolar process, this can be solved by external Sinus Graft (Boyne 1980). The alveolar crest can be built up to 8-15 mm by Sinus Elevator (Incidence 25-40%).

The alveolar crest can be built up to 8-15 mm by Sinus Elevator (Incidence 25-40%). Some circumstances following failures are based on the in perforation of the Schneiderian membrane (Incidence 25-40%), perforation of the Schneiderian membrane along with an intra-operative lower success rate often comes up to 97.9% survival rate in after years (Pelegr 2000). Guided Bone Regeneration (GBR) as state of the art method for bone grafting uses in most cases bioresorbable membranes. Resorbable membranes offer several advantages beside the easy handling, as no need for a second surgical procedure for removal or minimization of complications, e.g. soft-tissue dehiscences.

The during the procedure gained autogenous bone can be placed alone or in combination with a bone graft material (eg. Compact Bone S, biphasic Calciumphosphate) around the placed implant. Sinus Eleva- tion with simultaneous implant placement is indicated with up to 97.9% survival rate in after years (Pelegr 2000). Guided Bone Regeneration (GBR) as state of the art method for bone grafting uses in most cases bioresorbable membranes. Resorbable membranes offer several advantages beside the easy handling, as no need for a second surgical procedure for removal or minimization of complications, e.g. soft-tissue dehiscences.

Sinus lift with simultaneous implant placement

The improved stability is based on micro threads with increased contact in neck area. The autogenous bone is gained during surgical procedure within piezo hused window preparation and drilling process (Fig. 1).

For filling of horizontal-cranial space and stabilization of bone lid a bovine bone graft is used (Compact Bone B; Dentegris, Germany). Bovine bone has been used in dental surgery for decades and is well known for stable and reliable results.

To ensure the barrier and to stabilize the particulated bone-graft material a pericon- dimum membrane with a resorption time of 16-24 weeks is used (Bone Protect Membrane; Dentegris, Germany). The pericondi- um membrane offers very good handling properties in combi- nation with a prolonged barrier function.

Case Study

After release of the sinus membrane (Fig. 4) the implant tunnel was prepared (Fig. 5) and the Implant (SL Implant; Dentegris, Germany) placed (Fig. 6). Simultaneously the surrounded space was covered with a re-hydrated Collagen Membrane (Bone Protect Membrane; Dentegris, Germany) as protections of the Schneiderian membrane (Fig. 7). Autogenous bone was mixed with Compact Bone B and placed in the sinus for stabilization (Fig. 8).

After control of primary stabili- ty particulate materials was filled laterally and covered with pericard membrane according to GBR standards (Fig.9). The flap was readapted and closed, control by X-ray shows axial position and augmentation of sinus maxillaris (Fig. 10).

Reentry after five months was accompanied by full ceramic crown and results in aesthetic and harmonious rehabilitation (Fig. 11).

Single tooth rehabilitation with implant is the appropriate method instead of conventional use of bridge. In the reported case the situation is aggravated by the lowered sinus and lateral limita- tion by intact adjacent teeth.

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O ral rehabilitation has been paid notice for a long time to regain maxillary function and for aesthetic reasons. Implant placement in the maxilla is often limited due to missing height of the alveolar process, this can be solved by external Sinus Graft (Boyne 1980). The alveolar crest can be built up to 8-15 mm by Sinus Eleva- tion. The function of the sinus is not touched by the reduced vol- ume, the success rate is between 85 to 90 % after 15 years. The lower success rate often comes along with an intra-operative perforation of the Schneiderian Membrane (Incidence 25-40%), failures are based on the in some circumstances following perforations. In opposite of app 25% perforations with bone milling devices the use of piezo- surgical devices can lead to perforation rates of 5%.

At external elevation and sinus augmentation a second surgical can be avoided by simultaneous implantation in case of 5 mm bone height. During the Eleva- tion of Schneiderian Membrane with simultaneous implant place- ment is indicated with up to 97.9% survival rate in after years (Pelegr 2000). Guided Bone Regeneration (GBR) as state of the art method for bone grafting uses in most cases bioresorbable Mem- branes. Resorbable membranes offer several advantages beside the easy handling, as no need for a second surgical procedure for removal or minimization of complications, e.g. soft-tissue dehiscences.

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Case Study

The patient (36 y, f) was showing an alveo lacer tooth in 15 (Fig. 2). Patient request was aesthet- ic and masticatory rehabilitation which was suggested by one- sided partial edentulism.

Based on diagnostic planning piezo- surgical window preparation in 15 (Fig.5) was performed after local anesthesia and peritotal flap. By choosing a round-oval lid design sharp edges can be avoided which reduces the risk of perforation.

After release of the sinus mem- brane (Fig.4) the implant tunnel was prepared (Fig. 5) and the Implant (SL Implant; Dentegris, Germany) placed (Fig. 6). Simultaneously the surrounded space was covered with a re-hydrated Collagen Membrane (Bone Protect Membrane; Den- tegris, Germany) as protections of the Schneiderian membrane (Fig. 7). Autogenous bone was mixed with Compact Bone B and placed in the sinus for stabilization (Fig. 8).

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By Ritter Implants

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