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 on the subject to assess and support their success. (Figure 1)

Implants were originally tilted in a bodily fashion to bypass certain anatomical structures that otherwise hindered clinicians from placing them in areas such as the maxillary sinuses, inferior alveolar nerve canal, the mental foramen, mandibular lingual concavities and maxillary buccal concavities. Procedures such as nerve repositioning, various grafting procedures, distraction osseogenesis, 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 structures, the tilting of posterior implants in a distal manner results in an increase in the implant platform emergence of the prosthetic teeth thereby allowing better load distribution, and reducing the cantilever length with time. Tilted implants became an effective and safe alternative to major augmentation procedures such as maxillary sinus grafting procedures or ridge augmentation procedures.

Initially there were negative responses 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 between angled and straight implants. Krikkanos 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 Misch et al in 2012 evaluated the outcomes of upright and tilted implants supporting full arch fixed and removable prostheses allowing immediate rehabilitation of edentulous maxillae, after at least 1 year of loading. No statistically significant mean difference between tilted and upright implants was found with regards to bone loss. Rosén et al in 2013 retrospectively evaluated the surgical effect of different angles in the severely resorbed edentulous maxilla as opposed to bone grafting and conventional prosthetics to restore the posterior maxilla. In a ten-year study patients with tilted implants demonstrated a beneficial alternative to the more demanding grafting techniques.

Angled abutments
Furthermore while angled implants improved load distribution, reduced augmentation procedures, lessened cost, treatment time and eliminated cantilever forces in many cases they did need to have the use of angled abutments to achieve a parallel path for the final prosthetic restoration. 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 prosthetic device. 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 endosseous platform 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 casting imperfections between angled and straight abutments. Krikkanos et al in 2000 found that the use of custom abutments may cause unfavorable peri-apical pathologies and peri-implantitis. Thirdly, the need of angled abutments decreases the amount of buccal bone that can cause unfavorable peri-apical pathologies and peri-implantitis. However, the use of angled abutments is eliminated when using Co-Axis implants. When using Co-Axis implants the platform emerges in an optimal esthetic angle and relatively parallel to other implants in the arch thereby allowing the fabrication of screws retained full arch restorations. Subsequently the use of custom and costly abutments are eliminated. Regarding the strength of Co-Axis Implants, Howes et al showed higher stress analysis on straight implants as opposed to Co-Axis implants and found the use of Co-Axis Implants to be less than that needed to deform fixtures and cause prosthetic complications. (Figure 3)

The use of Co-Axis Implants (Southern Implants Irvine, California) introduced eleven years ago further research and testing. Co-Axis Implants feature 12°, 24° or 36° correction angles (built into the implants) which allow for implant placement into existing native bone without the need of costly, time consuming and painful bone grafting augmentation procedures or the use of angled abutments. When using Co-Axis Implants the fixture platform emerges in an optimal esthetic angle and relatively parallel to other implants in the arch thereby allowing the fabrication of screws retained full arch restorations. Subsequently the use of custom and costly abutments are eliminated. Regarding the strength of Co-Axis Implants, Howes et al showed higher stress analysis on straight implants as opposed to Co-Axis implants and found the use of Co-Axis Implants to be less than that needed to deform fixtures and cause prosthetic complications. (Figure 3)

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

Figure 2. Angled abutments

Figure 3. Co-Axis Implants in three different connection

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

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

Anterior Maxilla
Implants in the esthetic area has been a popular topic in 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 resorptive properties of the buccal plate. The anatomic limitation is the common buccal concavity associated with the pre maxillary region. The anatomic limitations of the anterior maxilla often require either an angulated 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 exposure 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 cemental 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 minimum of 2mm of buccal bone that will ensure the stability and firmness of the gingival position in the esthetic area. (Figure 4)

Posterior area
As mentioned earlier the use of angled implants not only aids with the bypassing of anatomical constraints that would otherwise require grafting procedures, but also aids with load distribution and the elimination of long cantilevers (Figure 5). The mental foramina, maxillary sinus and severe concavities can be avoided with the use of angled implants. However this necessitates the use of angled abutments to correct the severe distal inclination of the implants. The use of the Co-Axis Implants facilitates the avoidance of anatomic limitations, shortening of cantilevers, and enables the use of screw retained restoration without the need of angled abutments. The use of angled abutments is hence not necessary since Co-Axis Implants correct the angulation within the body of the implant.

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 19mm 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 5-D position of the desired access hole within the surgical guide (Figure 6). The angled direction 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-
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**About the Authors**

Costa Nicolopoulos BDS, FFD (SA) MFDS
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Dr. Costa BDS qualified as a dentis in 1984 receiving his dental degree cum laude from the University of Witwatersrand, Johannesburg, South Africa. He graduated top of his 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.

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Dr. Safa Tahmasebi completed his Bachelor’s 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 prosthetics 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.

**References**

Sinus lift with simultaneous implant placement

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

By Dr. Peter Hentschel

oral rehabilitation has been paid notice for a long time to regain mutilatory 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 Elevation. The success rate is between 85 to 96% 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 complications. In opposite of app 25% perforations with bone milling devices the use of piezoeurgical 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 Elevation of Schneiderian Membrane with sandwichtechnique autologous bone and bone substitute materials are used (Kamikawa et al. 2006). To resist the respiratory pressure non-resorbable bone substitute material (eg. Compactbone R, bovine Bone) or the cranial bone lid are placed next to sinus membrane.

The during the procedure gained autologous bone can be placed alone or in combination with a bone graft material (eg. Compact Bone B, biphasic Calcituniciphosphate) around the placed implant. Sinus Eleva-
tion with simultaneous implant placement is indicated with up to 97.0% survival rate in after years (Pelegr et al. 2000).

Guided Bone Regeneration (GBR) as state of the art method for bone grafting uses in most cases biodegradable 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.

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 limits by intact adjacent teeth. For lateral one-stage sinus lift means we are using the special designed Sinus-Lift implant for increased primary stability (SL Implant; Dentegris, Germany). The improved stability is based on micro threads with increased contact in neck area. The autologous 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-grafting material a pericar-
dium membrane with a resorption time of 16-24 weeks is used (Bone Protect Membrane; Den-

tegris, Germany). The pericardium membrane offers very good handling properties in combi-
nation with a prolonged barrier function.

Case Study

The patient (36 y, f) was showing an alveo loco lost tooth in 15 (Fig. 2). Patients request was aesthet-
ic and masticatory rehabilitation which was suggested by one-

Based on diagnostic planning pie-

Fig. 1. Autologous Bone

Fig. 2. Pre-clinical situation

Fig. 3. Piezoeurgical Preparation

Fig. 4. Release of Schneiderian Membrane

Fig. 5. Preparation of Implant Tunnel

Fig. 6. SL-Implant In Situ

Fig. 7. Bone Protect Membrane In Situ

Fig. 8. Grafting with Bovine Bone

Fig. 9. Covering of Sinus Membrane with Bone Protect Membrane

Fig. 10. X-ray Post - OP

Fig. 11. 12 month Post-OP
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