Modern implants from a different angle

By Safa Tahmasebi DDS, MS (USA) Prosthodontist; Costa Nicolopoulos BDS, FFD (SA) Oral & Maxillofacial Surgeon

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 carried out to study and assess their support. (Figure 1)

Implants were originally tilted in a bodily fashion to bypass certain anatomic structures that otherwise hindered clinicians from placing them in areas such as mental foramen, maxillary sinus, inferior alveolar canal, the mental foramen, mandibular lingual canals and maxillary buccal canals. 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 structures, the tilting of posterior implants in a distal manner results in an increase in the height of the prosthesis thereby allowing better load distribution, and reducing the cantilever lengths, with time, tilted implants became an effective and safe alternative to major augmentation procedures such as maxillary sinus grafting procedures and cleft augmentation procedures.

Initially, there were negative opinions regarding the hard and soft tissue response around tilted implants as opposed to axially straight implants. However in vivo and in vitro studies have proven no apparent long-term detrimental effects between angled and straight implants. Krekovanos 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 Melcher et al in 2012 evaluated the outcomes of upright and tilted implants supporting full arch posterior dentures and immediate rehabilitation of edentulous maxillae, after at least 1 year of observation. No 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 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 showed a more realistic 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 cantilevers in many cases they did necessitate the use of angled abutments to achieve a parallel path for the draw of the final prosthesis. 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 prostheses. 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 practitioner 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 a negative effect on achieving a proper angulation between angled and straight implants. Kreykanos 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 Melcher et al in 2012 evaluated the outcomes of upright and tilted implants supporting full arch posterior dentures and immediate rehabilitation of edentulous maxillae, after at least 1 year of observation. No 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 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 showed a more realistic alternative to the more demanding grafting techniques. (Figure 3)

The use of Co-Axis Implants (Southern Implants Irvine,California) introduced eleven years ago further redefined the concept of angled abutments. The Co-Axis angle correction allows 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 screw retained full arch restorations. Subsequently the use of cements and costly augmentation procedures or the use of angled abutments the inflamatory response due to the micro gaps created in the abutment interface is eliminated. Regarding the strength of angled abutments, Hovres et al showed higher stress analysis on straight implants as opposed to Co-Axis implants and found that the use of Co-Axis Implants to be less than that needed to deform fixtures and cause prosthetic complications. (Figure 4)

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 anatomical limitations and the higher resorative properti es 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 adjunctional 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 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 minim um of 2mm of buccal bone that will ensure the stability and firmness of the gingival position in the esthetic area. (Figure 5)

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 10mm 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 ang 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-
What we know

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Today more clinicians are adopting Co-Axis implants. This leads to less grafting procedures that not only minimize 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 conventional implants. Therefore, the use of native bone, the avoidance of expensive angulated abutments, decreased patient morbidity, reduced cost, benefits of immediate loading, likelihood of screw retained restorations, and elimination of long cantilevers are all advantages of using Co-Axis implants.

References

Conclusion

Today more clinicians are adopting Co-Axis implants. This leads to less grafting procedures that not only minimize 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 conventional implants. Therefore, the use of native bone, the avoidance of expensive angulated abutments, decreased patient morbidity, reduced cost, benefits of immediate loading, likelihood of screw retained restorations, and elimination of long cantilevers are all advantages of using Co-Axis implants.

About the Authors

Costa Narolopoulos BDS, FFD (SA) MFOS
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) MFOS. Since 1999 he is in full time specialist Maxillo-Facial & Oral Surgery private practice concentrating on immediate loading rehabilitation of the maxilla: a systematic review. J Dent Res. 2012 Sep; 91(9):821-7.


SameDay Dental Implants
Unit 107 ,Building 39, DHCC
Dubai, UAE.
PO Box 505190, Dubai , UAE.

Email: costa@samedayme.com
Safa@samedayme.com

Figure 6. 12° direction indicator within a surgical guide

Figure 7. Direction indicators left to right (0°, 12°, 24° and 36°)

Figure 8. The use of 12°, 24° and 36° implants in a fixed maxillary immediate loading rehabilitation

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Dr. Safa Tahmasebi D.D.S, M.S
Cert. Prosthodontist (USA)
Dr. Safa Tahmasebi Completed his Bachelor 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 2008. 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 program at the WVU University. In 2015 he joined the SameDay Dental implants Bränemark Osseointegration Center (BIOC) Dubai as a full time prosthodontist specializing in full mouth rehabilitation, immediate loading and Smile reconstruction.

Figure 1. Co-Axis implant in maxilla

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