Guided implant placement in the anterior zone

A clinically novel technique

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Introduction

Precision in implant placement is of utmost importance for achieving predictable aesthetics and successful restorations, especially in the anterior zone. The quest for accuracy has recently been aided by digital workflows and stereolithographic stents, which not only support planning the implant positioning by flapless procedures accurately but also make possible the prefabrication of a provisional restoration before the procedure. CAD/CAM technology helps reducing inadvertent time loss and manual errors of impression making, pouring casts and fabrication of prostheses.

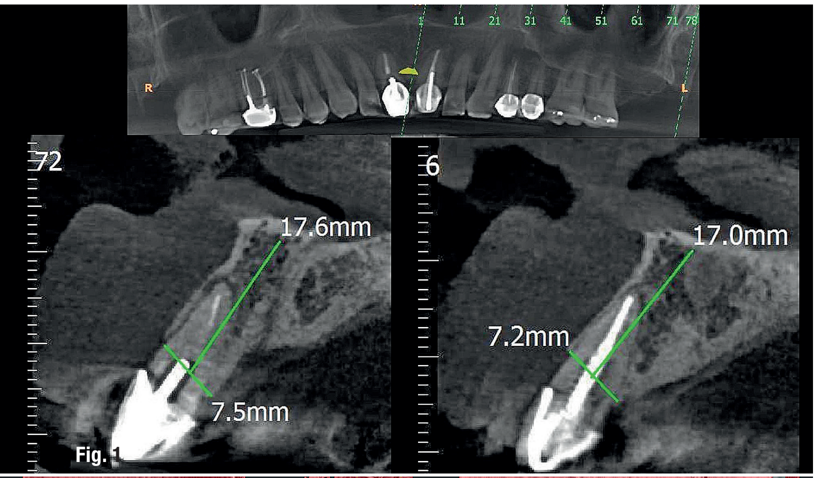


Fig. 1

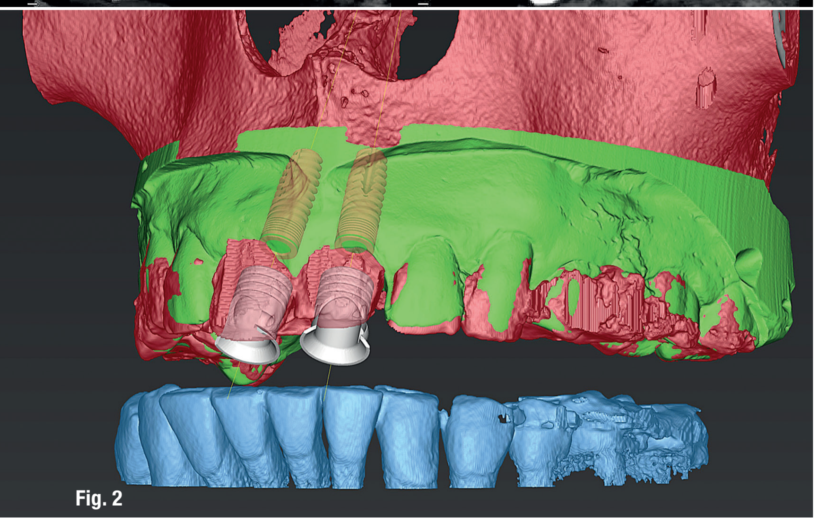


Fig. 2

Fig. 1: Pre-op CBCT showing periapical lesion at teeth #11 and 21.
Fig. 2: Virtual extraction and superimposition on scanned diagnostic cast.

The success rate of now routinely practised immediate implant placement and immediate loading exceeds 95 %, and this protocol has the added advantage of reducing the treatment duration and helping restore the aesthetics during the healing phase.[1] During this period of osseointegration, it is imperative to assure soft loading and restrict micromotion on the implants. This is done successfully with softer materials like BioHPP (bredent medical), which is a ceramic-reinforced high-performance polymer. The modulus of elasticity is similar to that of human bone, thereby attenuating masticatory forces, unlike conventional materials, which could cause a direct load transfer to the underlying bone and sometimes with occlusal interferences even ceramic fractures and temporomandibular joint problems.[2] Biocompatibility is the ability of a material to perform with an appropriate host response in a specific situation. It can also be defined as the ability of a restorative material to induce an appropriate and an advantageous host response during its intended clinical usage.[3] BioHPP, owing to its virtue of biocompatibility, has a favourable soft-tissue response and, by virtue of its colour, is a material of choice for anterior restorations, as demonstrated by a recent animal study by Maté Sánchez de Val et al.[4]

In the transitional phase of soft- and hard-tissue healing with immediate implantation in the anterior zone, the provisional crown should be aesthetic, as well as have superior strength. This is marvellously achieved with long-term provisional crowns fabricated with breCAM.multiCOM (bredent medical). It is manufactured from polymethyl methacrylate (PMMA) and has been offset with > 20 % ceramic fillers in order to increase strength. The multi-chromatic-layered CAD/CAM block of breCAM.multiCOM gives the dental prosthesis a natural colour gradient.

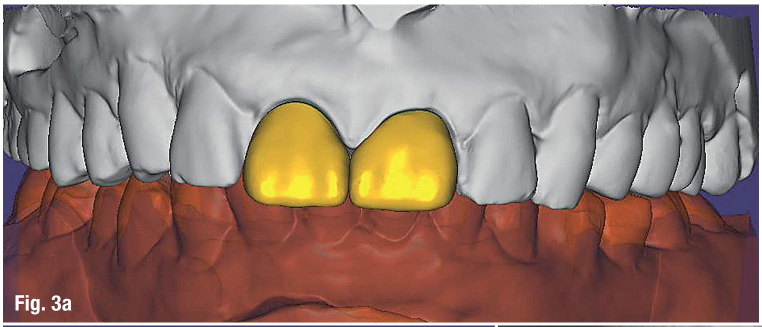
The success of the immediate implant placement protocol has been made predictable by the use of photodynamic therapy (soft laser disinfection) using HELBO (bredent medical). This ensures focused antibacterial action before immediate placement of implants, thereby improving the implant osseointegration prognosis. HELBO therapy entails use of a blue photosensitiser, which diffuses in the bacterial biofilm. The dye molecules are activated using the TheraLite laser (660 nm), resulting in release of aggressive singlet oxygen molecules and thereby causing destruction of bacteria in the biofilm. This anti-infective therapy increases the certainty of immediate implant procedures in infected sockets. The following case report describes rehabilitation of ailing maxillary central incisors following a completely digital workflow.

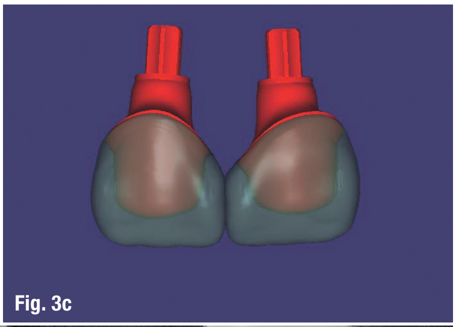
Case presentation

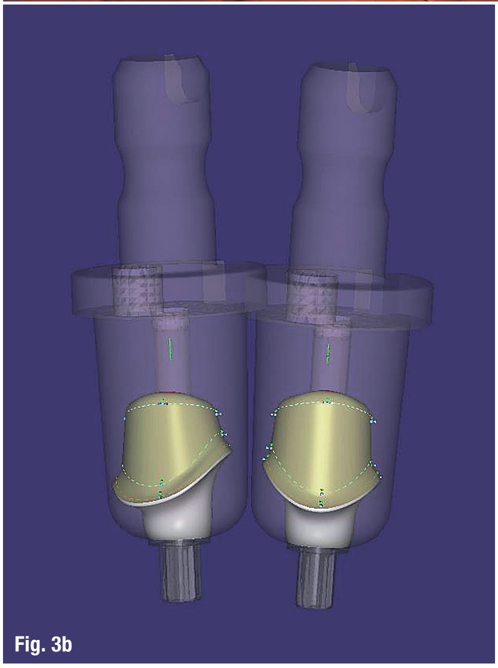
A 45-year-old male patient presented reporting pain and discomfort of his maxillary central incisors. Clinically, the teeth (with metal–ceramic crowns) were mobile from the post build-up, and radiographic examination with a CBCT scan showed a periapical lesion associated with his maxillary central incisors (Fig. 1). The long-term prognosis of the ailing teeth was ascertained as poor.

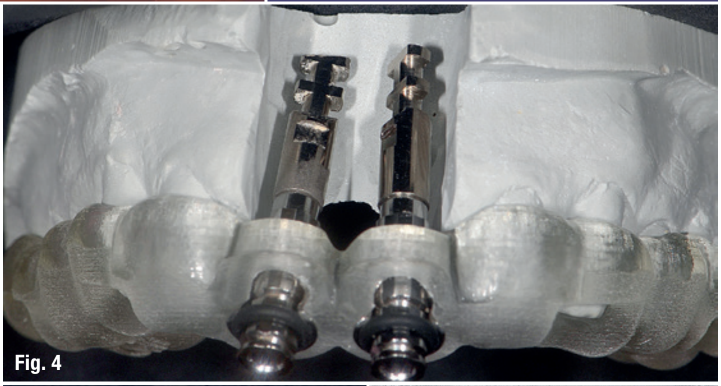
Presurgical phase

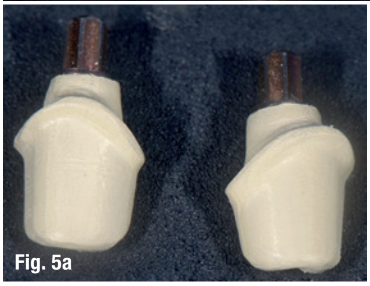
A thorough 3D treatment planning was done using the preoperative CBCT scan and coDiagnostiX software (Dental Wings). Owing to the presence of sound, adequate apical and palatal bone, an immediate extraction and implant placement procedure was planned. Fabrication of a stereolithographic stent for fully guided placement of implants was completed. This entailed virtual extraction of the central incisors and superimposition on the scanned diagnostic cast (Fig. 2). Using the coDiagnostiX software, the implant position and size were planned. This information was shared with the laboratory to prefabricate the one-time final custom abutments using BioHPP SKY elegance prefabricated abutments (bredent medical). The designing of these was done in exocad, based on the cut-back of the digitally designed provisional crowns to be fabricated from breCAM.multiCOM (Figs. 3a–c). The subgingival collars of the abutments were customised to support the soft-tissue profile of the scored casts. Using the surgical stent, the implant analogues were inserted into the planned positions on the cast (Fig. 4) and the fit of the one-time final abut-











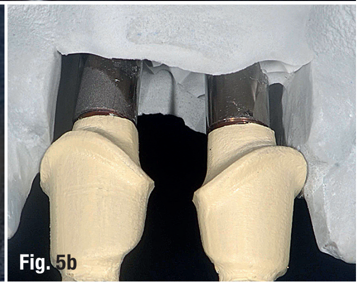


Fig. 3a: Digitally designed provisional crowns. **Fig. 3b:** Abutments customised digitally. **Fig. 3c:** Crowns designed after abutment preparation digitally. **Fig. 4:** Laboratory analogues on the model. **Fig. 5a:** Customised BioHPP SKY elegance prefabricated abutments. **Fig. 5b:** Trying of the customised abutments on the cast.

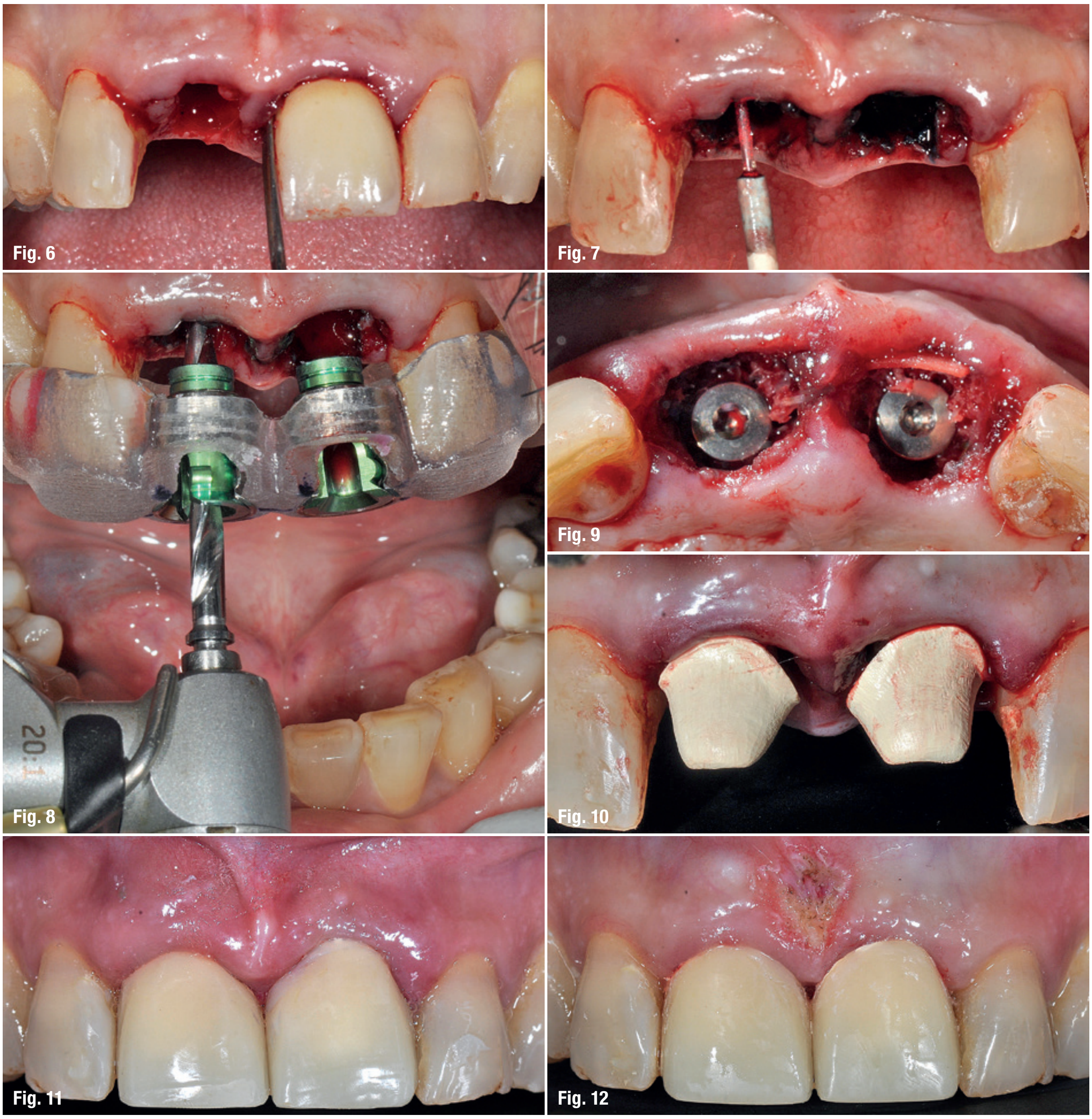


Fig. 6: Atraumatic extraction using luxatomes. **Fig. 7:** HELBO asepsis. **Fig. 8:** Flapless guided surgery—primary sleeve. **Fig. 9:** Guided bone regeneration using a membrane and cancellous bone grafting material. **Fig. 10:** Customised one-time abutments inserted after implant placement. **Fig. 11:** Customised breCAM.multiCOM provisional crowns cemented. **Fig. 12:** Laser frenectomy done.

ment and provisional crown was checked in the laboratory prior to surgery (Figs. 5a & b).

Surgical phase

The procedure was performed under local anaesthesia using the infiltration technique. Atraumatic extraction was done of the maxillary central incisors using periotomes and luxatomes (Fig. 6). Proceeding a thorough curettage, HELBO disinfection was performed intra-socket for reduction in the bacterial load (Fig. 7). The surgical guide was inserted in place, and with the predetermined sleeve sequence, the osteotomy site was gradually primed flapless (Fig. 8). The SKY implants (bredent medical) were inserted and a torque of > 35 Ncm was achieved. There was a dehiscence on the labial bone plate of the right central incisor alveolar socket, for which tunnelling was done beyond the defect and guided bone regeneration was performed by inserting a collagen membrane (angiopore, bredent medical) to prevent soft-tissue ingrowth during the period of osseointegration (Fig. 9). Since the jumping distance was more than 2 mm, the socket was grafted with a particulate cancellous bone augmentation material (0.25 cc; Rocky Mountain Tissue Bank).

The final customised BioHPP SKY elegance prefabricated abutments were torqued to 25 Ncm in the predetermined positions (Fig. 10) and the screw access plugged with Teflon. The digitally prefabricated breCAM.multiCOM crowns were relined for an accurate marginal fit and soft-tissue support, and cemented on to the abutments using Premier Implant Cement (Premier Dental; Fig. 11).

After eight weeks, the high labial frenulum attachment, which was causing a pull on the inter-implant papilla, was eliminated by laser frenectomy (Fig. 12). Soft-tissue remodelling of the papilla was done by adjusting the contact point of the temporary crowns to within a 4 mm distance from the inter-crestal bone, to induce regeneration according to Tarnow's principle (Fig. 13).[5] Also, a lateral build-up of the crown contours helped squeeze the papilla downwards, closing the black triangular space between the crowns.

Prosthetic phase

At 12 weeks, the temporary crowns were detached from the abutments, the collar margins adjusted to an equi-gingival level and intraoral abutment level, a digital scan (CS 3600, Carestream Dental) was performed and the STL file digitally transferred to the dental laboratory (Fig. 14). Using the DentalCAD software (exocad), the final crowns were designed and milled from IPS e.max (Ivoclar Vivadent) in the laboratory. As these were layered crowns, 3D models were printed for the laboratory procedure (Fig. 15). After a crown trial, the BioHPP SKY elegance abutments were coated with visio.link primer (bredent medical; cured for 90 seconds) and the crowns treated with hydrofluoric acid, washed and dried, and a universal bond applied. The crowns were cemented with dual-curing resin cement. Optimal aesthetics with a good emergence profile was achieved owing to the preservation of both the hard- and soft-tissue, and the patient was satisfied with the clinical outcome (Fig. 16).

Discussion

The digital workflow in implant dentistry has made optimal implant positioning possible with pre-planning and use of a surgical guide. Prefabricating final abutments and provisional crowns helps maintain the tissue profile, assuring an immediate restoration, as well as the aesthetic appearance, to the patient during the entire treatment period.

In the current case report, a stereolithographic stent was fabricated based on the CBCT scan for accurate implant placement. A systematic review concluded that guided placement has at least as good an implant survival rate as conventional protocols do.[6] However, several unexpected procedure-linked adverse events during guided implant placement indicate that the clinical demands on the surgeon were no less than those during conventional placement. A flapless approach was possible because of the stent. A flapless approach prevents stripping of the periosteum, improving blood supply at the surgical site. Flapless implant placement appears to be a useful procedure, based on accurate and reliable CBCT image data and dedicated implant planning software.[7]

An immediate implant placement and loading protocol was followed in the current case. Anitua et al. concluded that immediate loading of implants inserted into fresh and infected extraction sockets is not a risk factor for implant survival.[8] A current study of Prof. Arturo Novães, presented at EuroPerio in Amsterdam in the Netherlands, showed that, with the disinfection of the extraction alveolus with HELBO, better bone quantity and quality in the healing time could be achieved.[9]

Gallucci et al., whose study results were presented at the fifth ITI Consensus Conference, stated that for the anterior region, immediate and early loading of single-implant crowns are predictable procedures in terms of implant survival and stability of the marginal bone.[10] However, data regarding soft-tissue aspects is not conclusive enough to recommend immediate or early loading of single-implant crowns in aesthetically demanding sites as a routine procedure. Immediate loading in such sites should be approached with caution and by experienced clinicians.[10]

The one abutment at one time concept is very beneficial for maintaining crestal bone levels in post-extractive sockets.[11]

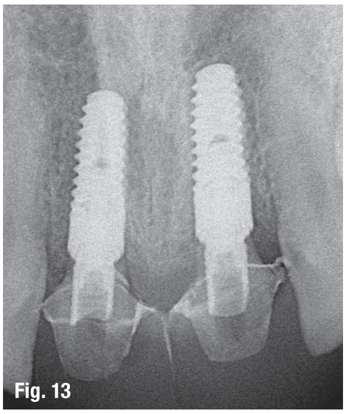


Fig. 13

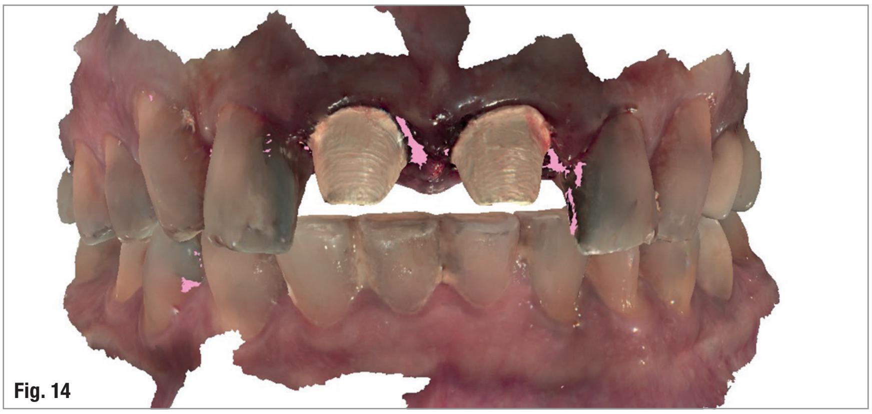


Fig. 14

Fig. 13: Digital radiograph showing the distance between the contact point of the crowns and interdental bone to be less than 5 mm. **Fig. 14:** Digital intraoral scan after three months for final crowns.

A recent meta-analysis found less bone loss for one abutment at one time over a longer follow-up period.[12] BioHPP was the material of choice for the one-time abutment, as it ensures soft loading during the healing period by virtue of its biomechanical properties and has a superior gingival response. It also offers improved aesthetics in the anterior zone owing to its non-metallic, light, dentine-like colour.[2] The provisional crowns were fabricated with breCAM.multiCOM owing to its strength and aesthetics. It is a PMMA integrated with > 20 % ceramic fillers, and therefore, this restoration can last for up to two years. The multi-chromatic layering of breCAM.multiCOM gives the dental prosthesis a natural colour gradient.[2]

A digital intraoral scan was taken of the one-time abutments for fabrication of the final crowns. A study revealed that crowns based on intraoral scans had a significantly better marginal fit and better interproximal contacts than crowns based on physical silicone impressions.[13]

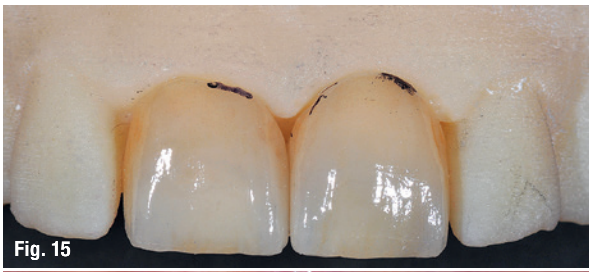


Fig. 15


Fig. 16

Fig. 15: Final IPS e.max crowns on printed models. **Fig. 16:** Final IPS e.max crowns cemented.

Conclusion

The digital workflow in implant dentistry constitutes a paradigm shift from traditional protocols, enabling accurate treatment planning and predictability. However, long-term controlled studies are required to obtain conclusive evidence for clinical superiority of digital workflows for immediate implant restorations compared with conventional techniques. The use of new-age biomaterials with greater biocompatibility helps to improve tissue response and provides better aesthetic predictability.

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Literature

about the author

Dr Burzin Khan is a Mumbai-based dentist and published author. In 1990, he completed his MDS in Prosthodontics at the Government Dental College in Mumbai in India. He maintains his multi-speciality clinic Opus Dental Specialities. He is a mentor for the Mastership series programme on Implant Prosthodontics at Eduhub Mumbai. In addition, he is past President and one of the Founders of the Indian Academy of Osseointegration.

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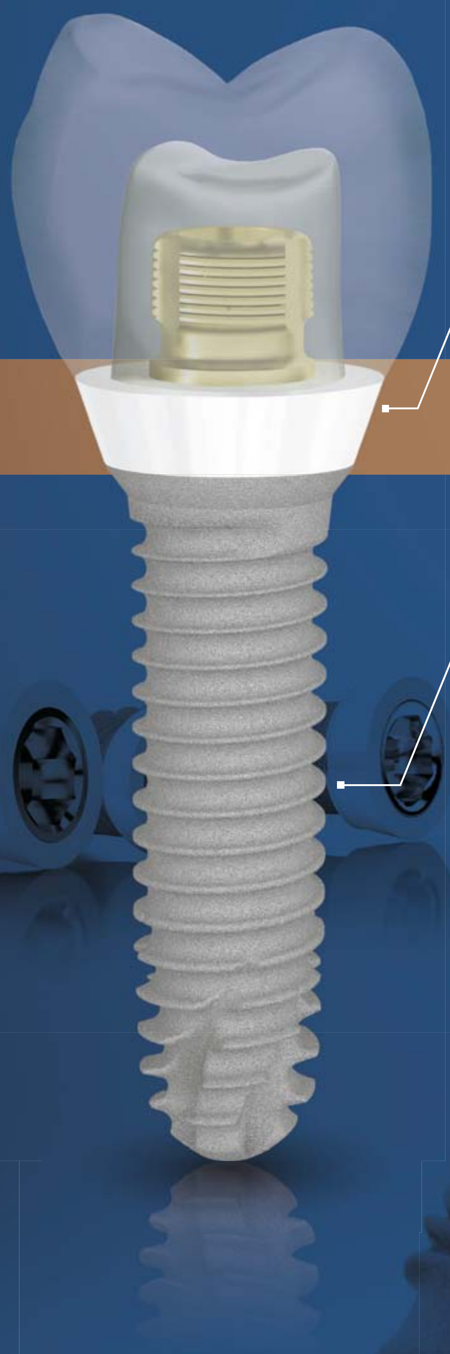

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