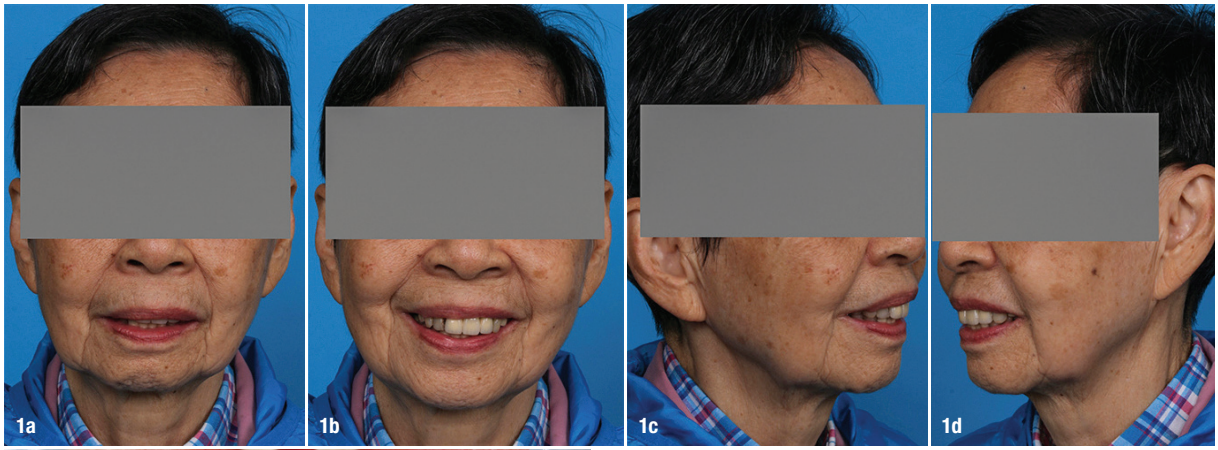
Full-mouth implant reconstruction using zygomatic and standard implants

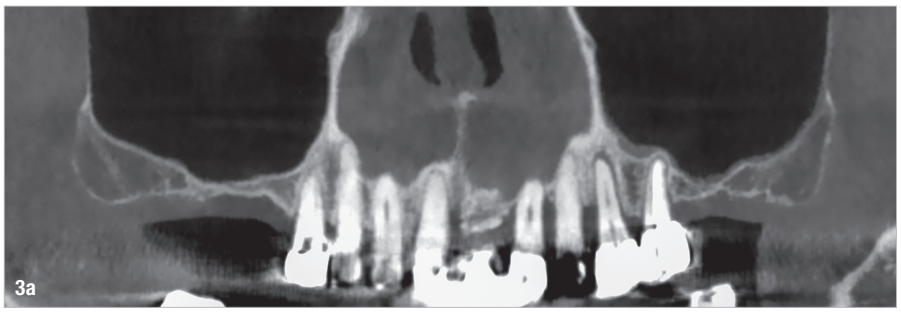
Dr James Kwok Fai Chow, China



Immediate implant insertion is indicated when treating patients with terminal dentition. In the case of full-arch implant reconstruction, clinicians usually couple immediate implant placement with immediate loading if the primary stability of these implants is adequate. If the residual bone volume is limited in the posterior maxilla, a zygomatic implant is often employed by experienced surgeons to minimise the extent of grafting and to support immediate loading. This article describes the dental implant treatment of an elderly lady who was suffering from terminal dentition. This patient had undergone full mouth clearance followed by double-arch immediate implant reconstruction using zygomatic and conventional implants.

Initial situation

A 76-year-old lady who complained of gum swelling and tooth mobility was a known case of hypertension and hyperlipidemia (Figs. 1a–d). She was taking antihypertensives regularly (amlodipine 5 mg at night; losartan 50 mg QD). In addition, this patient had undergone a left hemithyroidectomy in 2018, as well as a spinal fusion many years ago. The patient was fit and ambulatory without any acute distress. Preoperative blood tests showed that she had mild vitamin D deficiency. Clinically, this patient suffered from multiple missing posterior teeth in her upper and lower jaws. The remaining teeth were diagnosed with secondary caries, chronic periodontal disease with clinical attachment loss, defective fillings and failing crown and bridgework (Figs. 2a–c). Radiological examination further revealed


3a

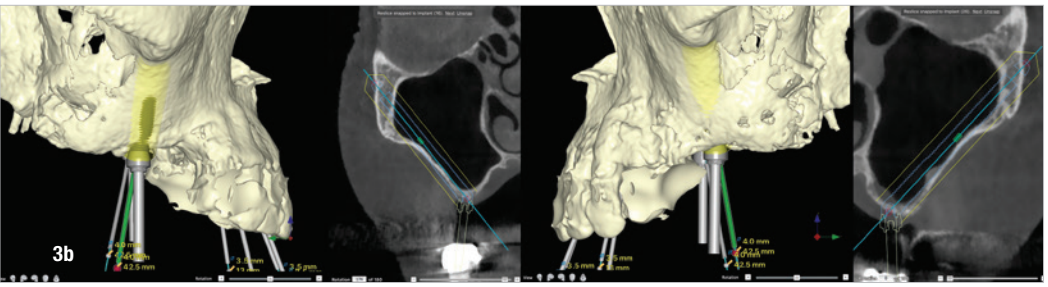
that the three anterior mandibular implants had extensive peri-implant bone loss, which was consistent with a clinical diagnosis of severe peri-implantitis.

Treatment planning

After undergoing a CBCT scan, the patient's DICOM files were exported for computer-aided implant planning (Figs. 3a & b). Third-party software was used for segmentation and simulation. To respect the biology and biomechanics for optimal functional and aesthetic outcomes, the treatment plan was formulated according to the principles of prosthetically driven implant planning (Figs. 4a & b). Important planning considerations included the distribution of the dental implants in a wider arc, the placement of dental implants according to the future tooth position, and the elimination of a distal cantilever on the prosthesis. Based on the clinical and radiological findings, this patient was found to have the following problems: 1) Terminal condition of the remaining upper and lower teeth; 2) Low-lying maxillary sinus floor bilaterally with limited residual bone volume; 3) Peri-implantitis of the anterior mandibular implants.

To solve these problems, the following treatment plan was explained and recommended to the patient and her family to consider: 1) Clearance of all remaining teeth; 2) Removal of the anterior mandibular implants; 3) Six conventional dental implants in the mandible for full-arch reconstruction; 4) Six dental implants in the maxilla for full-arch reconstruction including four conventional dental implants in the anterior maxilla and single zygomatic implants bilaterally; 5) Immediate loading using abutment-level screw-retained provisional prostheses; 6) Surgery under general anaesthesia. Once the patient had agreed with the proposed treatment plan, the CBCT DICOM files were segmented, and 3D printed jaw models were produced. These real-size jaw models were used for visualisation of anatomical structures and the mental rehearsal of the surgical steps (Fig. 5). In addition to CBCT diagnostic imaging and computer-aided planning, 3D printing is an invaluable technology in the digital workflow of implant dentistry.

BLX and ZAGA™ zygomatic implants (Straumann) were selected for this patient. The BLX Implant System is designed for immediacy. Straumann® Zygomatic Implants ZAGA™ flat and round were recently introduced to the market to provide implant surgeons with an extra tool to manage patients with severely atrophic maxilla. In this case report, a ZAGA™ round implant was selected based on the current ZAGA™ concept. According to the ZAGA™ classification,[1] a zygomatic implant may take an intra-sinus or extra-sinus path depending on the lateral maxillary sinus wall configuration. When an intra-sinus path is antici-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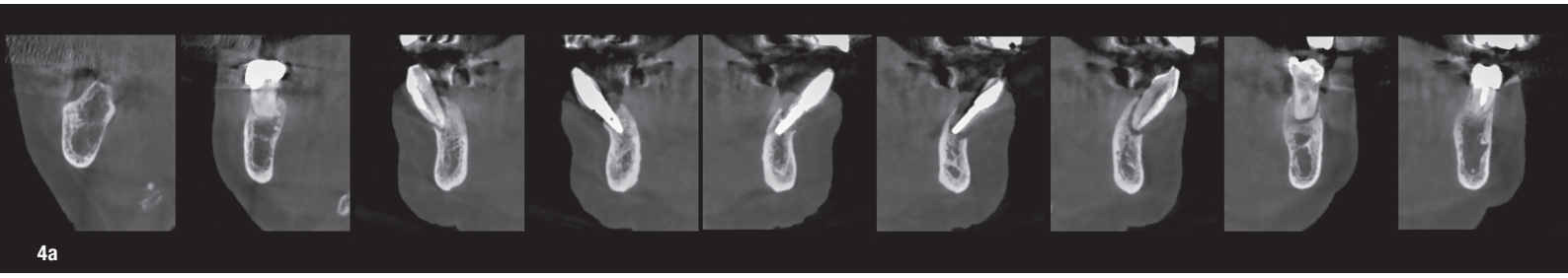

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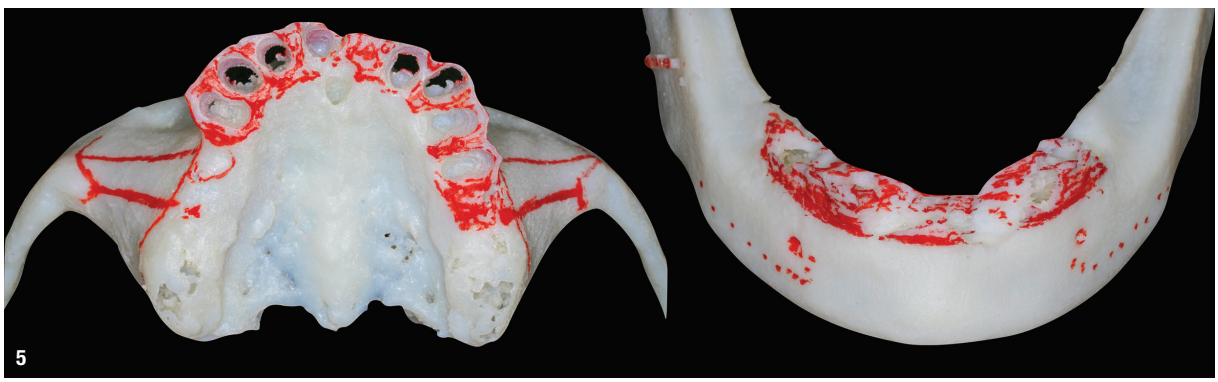
pated, a ZAGA™ round implant with threaded coronal portion is considered favourable. The BLX and the ZAGA™ zygomatic implant both share the same prosthetic platform. The SRA abutments are available for both implant systems, and these abutments are selected and connected immediately after implant placement to facilitate immediacy.

4b

Surgical procedure

Surgery was performed under general anaesthesia with naso-endotracheal intubation. After disinfection and draping, the patient underwent the following procedures: 1) Clearance of all the remaining teeth, excision and curettage of any granulation tissue; 2) Removal of the three implants in the anterior mandible; 3) Osseous reduction was conducted using piezoelectric surgery in the upper and lower jaws to provide adequate restorative space and to create a bone platform with sufficient width to support the chosen implants (Figs. 6a & b); 4) Implant placement in the mandible was completed by free-hand surgery (Figs. 7a & b); 5) Implant placement in the anterior maxilla was performed by free-hand surgery (Figs. 8a & b); 6) Prior to a zygomatic implant osteotomy, an extended lateral window was cut on both sides for an open sinus lift procedure (Figs. 9a & b); 7) Elevation of the maxillary sinus membrane was carried out by leaving the bone window attached to the Schneiderian membrane (Figs. 10a & b); 8) By locating the starting point and end point for the zygomatic implant placement, a zygomatic implant osteotomy was completed by sequential drilling (Figs. 11a & b); 9) Grafting of the sinus floor with xenografts (Bio-Oss collagen, Geistlich; Fig. 12); 10) Placement of zygomatic implants bilaterally (Figs. 13a & b); 11) Grafting of the coronal portion of the zygomatic implants with xenografts (Bio-Oss collagen, Geistlich; Fig. 14); 12) Covering the grafted site with collagen membrane (Bio-Gide, Geistlich); 13) Connection and tightening of SRA abutments; 14) Wound closure around the abutments and impression copings (Fig. 15); 15) Silicone impressions were made, and bite registration was taken for immediate prostheses.

An extended sinus lift is a technique introduced by Chow et al.[2] to eliminate the risk of maxillary sinusitis in zygomatic implant patients. In ZAGA™ type 0 and type 1 patients, the extended sinus lift technique keeps the zygomatic implant external to the maxillary sinus despite the fact that the implant has an intra-sinus trajectory. When an extended sinus lift is performed, it is recommended to graft the sinus for the following reasons: 1) To provide bone support around the coronal region of the zygomatic implant; 2) To increase the bone thickness to minimise the risk of development of an oral–antral communication. Implants with sufficient insertion torques were used for immediate loading (Table 1). In this case, except for the BLX implant



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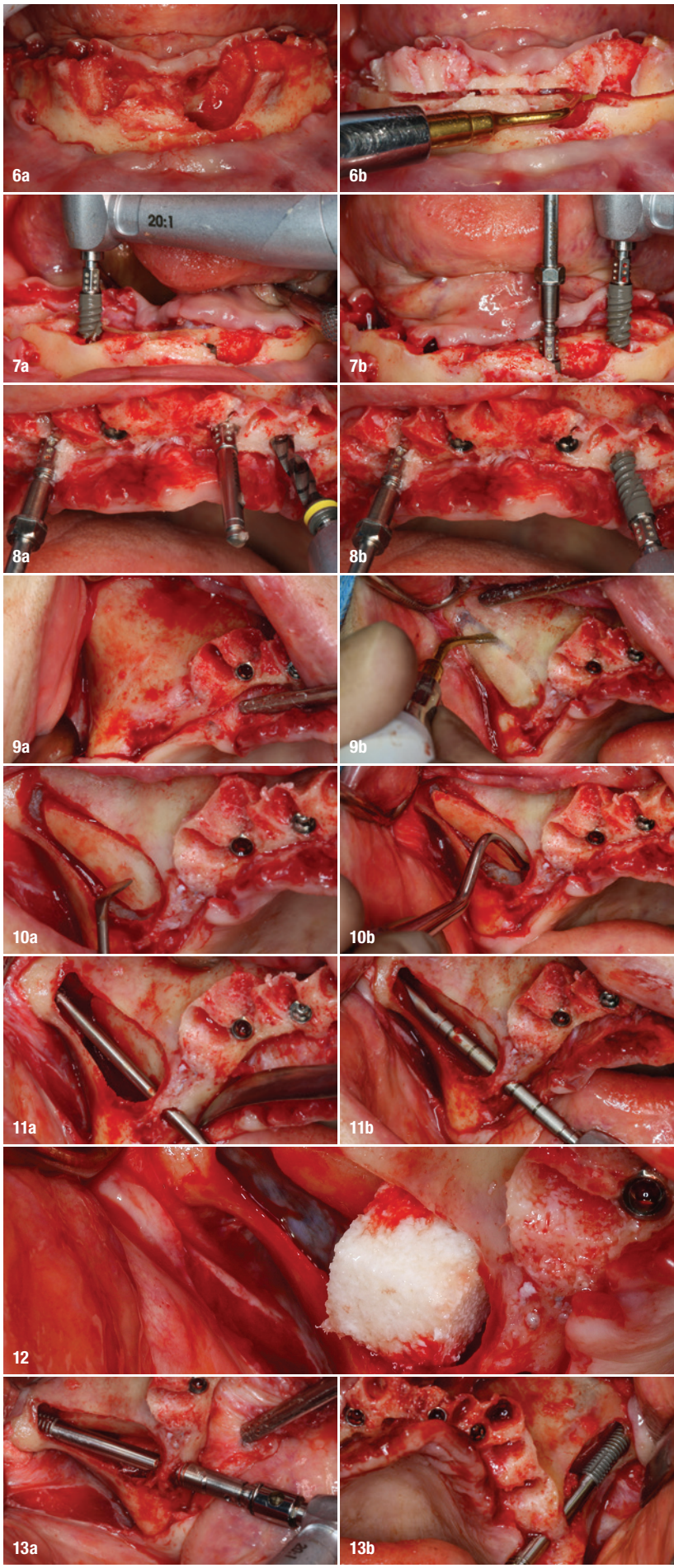
at the lower right first premolar location, all implants, including the zygomatic implants, were seated with insertion torques not less than 30 Ncm. Since the BLX implant at the lower right first premolar location had a low insertion torque, it was submerged for healing. The upper and lower working impressions and the bite registration were sent to the laboratory for fabrication of the screw-retained upper and lower acrylic prostheses. After the surgery, the patient was monitored in the recovery room. When the patient was fully awake and her vital signs were stable, she was discharged home. The patient was prescribed an oral analgesic (etoricoxib 120 mg QD), oral antibiotic (amoxicillin 250 mg TDS) and chlorhexidine mouthwash for 5 days.

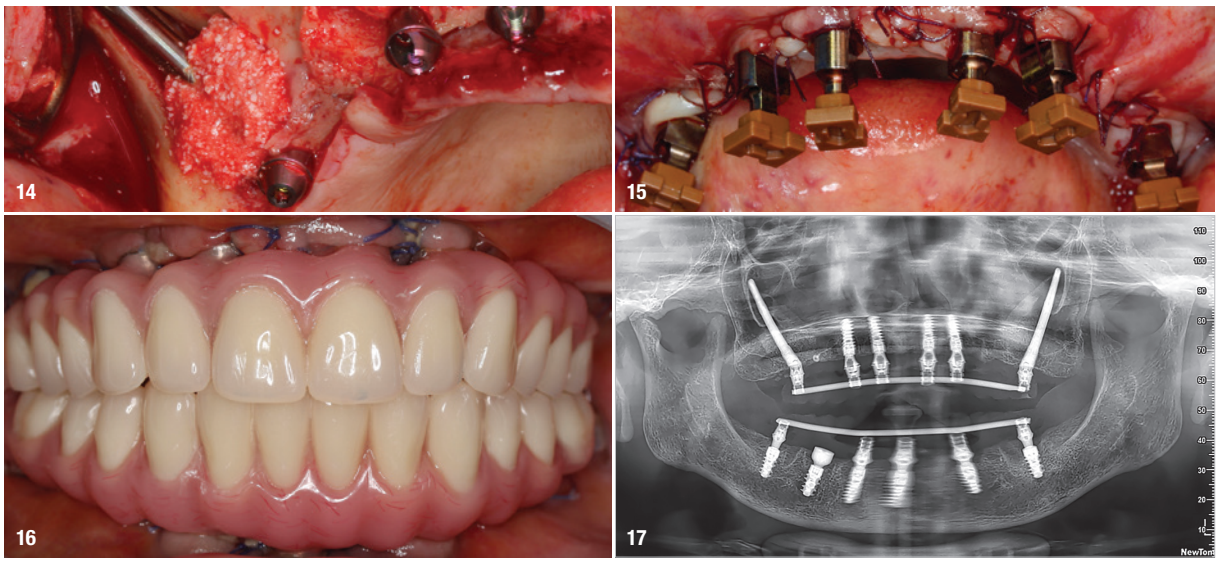
Immediate loading and prosthetic procedure

The patient returned for a follow-up visit 5 days after surgery. She presented with moderate facial swelling and bruising without complaining of pain. Clinically, the oral wounds were clean, and there was no bleeding or any signs of infection. Provisional acrylic, metal-reinforced prostheses were delivered for immediacy (Fig. 16). All the prosthetic screws were tightened manually, and screw access holes were sealed with a light-curing temporary composite resin (Fermit, Ivoclar Vivadent). An OPG was taken after the delivery of the immediate prostheses (Fig. 17). In this case, the following occlusal scheme for full-mouth implant reconstruction was adopted: 1) Prosthetically driven implant planning; 2) Dental implants with a moderately rough and hydrophilic surface; 3) No cantilever in the prostheses; 4) Even contacts in centric relation; 5) Shallow anterior guidance; 6) Group function on excursion; 7) Use of soft night guard. The patient was scheduled for regular review for wound healing and occlusal adjustment. The definitive prostheses were scheduled to be fabricated three to four months later.

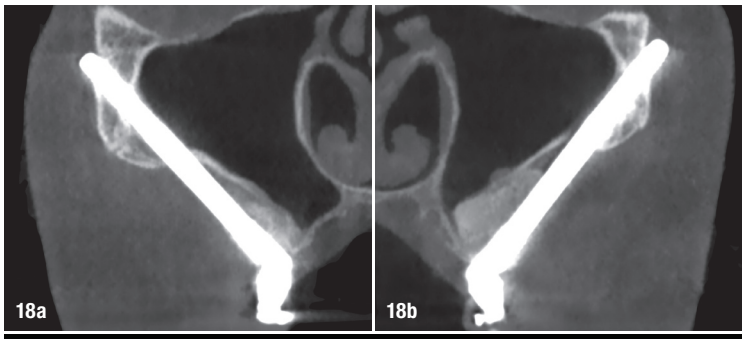
Treatment outcomes

A significant proportion of patients scheduled for full-arch reconstruction suffers from terminal dentition. Immediate implant placement and an immediate loading protocol help these patients cope with the implant treatment by minimising the stress and inconvenience associated with the edentulous phase. Meta-analyses have shown that immediate implant placement is just as successful as delayed implant placement in full-arch reconstruction. Moreover, immediate loading is predictable, with high implant survival rates compared to conventional loading. Of course, certain criteria exist for immediate loading, and good primary stability is considered essential. The BLX implant is designed for immediacy, and this implant system is indicated for all types of bone quality. In addition, in this case of a ZAGA™ type 0 classification, a ZAGA™ round implant was chosen. In order to achieve a more distal location to eliminate a cantilever effect, the starting point of the zygomatic implant is usually located





around the zygomatic alveolar crest region. Before performing the zygomatic implant osteotomy, a lateral sinus lift procedure was performed, and an extended window was opened from the sinus floor to the base of the zygoma bone. The Schneiderian membrane was elevated with the bone wall of the lateral window attached. It was important to preserve the integrity of the Schneiderian membrane. The purpose was to keep the zygomatic implant external to the maxillary sinus to reduce the risk of maxillary sinusitis. Grafting of the sinus floor and around the coronal portion of the zygomatic implant was performed. In principle, grafting increases the crestal bone support for the zygomatic implant and helps by distributing the functional loading more favourably compared to a situation without bone. Moreover, the increased bone thickness surrounding the coronal portion of the zygomatic implant creates a more robust hard tissue barrier between the oral cavity and the sinus cavity. This may prevent the development of an oral–antral communication after zygomatic implant treatment. To investigate the sinus reaction after zygomatic implant treatment, CBCT examination is useful to evaluate the sinus membrane thickness and patency of the osteo-meatal complex. In this case, the CBCT taken 3 months after surgery showed that there was no sinus membrane thickening and no obstruction of the ostium (Figs. 18a & b).



Maxilla	RZ #16	UR2 #13	UR1 #12	UL1 #21	UL2 #23	LZ #26
Implant	ZAGA Round 42.5 mm	BLX 4 mm x 12 mm	BLX 3.5 mm x 12 mm	BLX 3.5 mm x 12 mm	BLX 3.5 mm x 12 mm	ZAGA Round 42.5 mm
Torque	30 Ncm	40 Ncm	40 Ncm	40 Ncm	50 Ncm	40 Ncm
Mandible	LR3 #46	LR2 #44	LR1 #42	LL1 #31	LL2 #33	LL3 #36
Implant	BLX 5 mm x 10 mm	BLX 5.5 mm x 10mm	BLX 3.75 mm x 12 mm	BLX 3.75 mm x 12 mm	BLX 4 mm x 10 mm	BLX 5 mm x 10 mm
Torque	40 Ncm	20 Ncm	50 Ncm	50 Ncm	40 Ncm	40 Ncm

Table 1

Table 1: Recommended insertion torques of the zygomatic and standard implants used.

about the author

James Kwok Fai Chow BDS, MDS obtained his Bachelor of Dental Surgery and Master of Dental Surgery from the University of Hong Kong. In addition, he holds a Bachelor of Medicine and Bachelor of Surgery degree from the same University. He is a specialist in Oral and Maxillofacial Surgery. Dr Chow holds a Diploma in Implant Dentistry from the Royal College of Surgeons of England and is a Fellow of the International College of Dentists as well as an Honorary Clinical Associate Professor in Oral & Maxillofacial Surgery at the Faculty of Dentistry of the University of Hong Kong.

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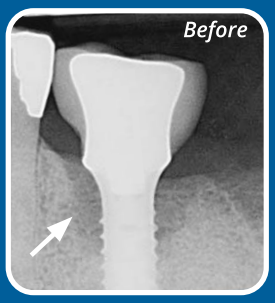

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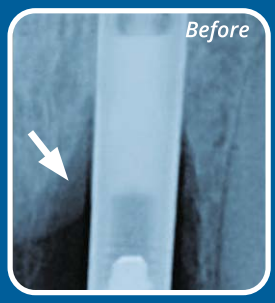

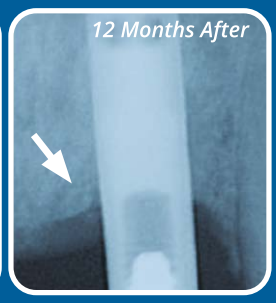

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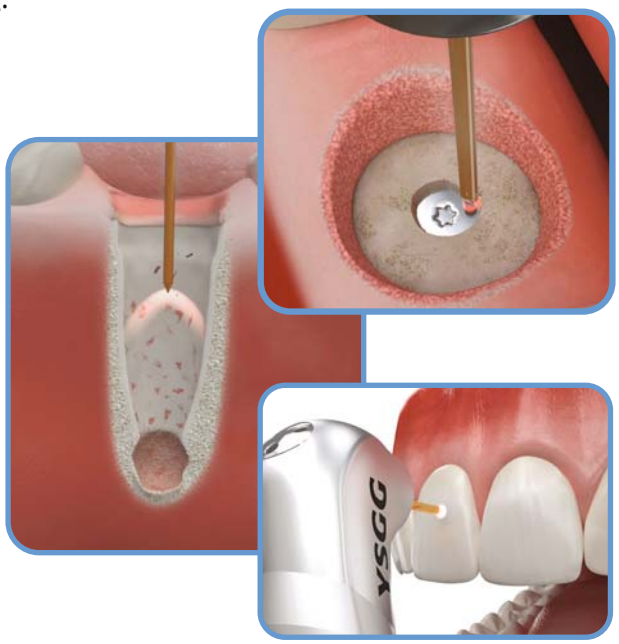

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