



## Advances in Dental Implantology

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### From last choice to first choice

Dental implant is gaining increasing acceptance by patients in Hong Kong. Many patients are actively seeking for dentists or dental specialists, who can provide dental implant treatment. With the increasing demand, many dentists attend continuing education courses of dental implantology being offered both locally and in overseas. There is wide acceptance in the dental teaching of adopting a minimal invasive approach on restorative dentistry and when combined with the improvement in reliability of implants, dental implant treatment has been transformed from the last choice to the first choice of treatment being offered to patients. This is particularly so in the last five years of this changing trend for single tooth replacement and replacing of the posterior edentulous space or free-end saddle situation.

### Critical factors of success

With the increasing research both in basic science and clinical trials coupled with improvement in dental implant designs, the success rate of the dental implants has been steadily improving to over 95%. The success rate is better in denser bone and particularly in the anterior mandible; the success rate reaches 99% in most centres. The critical factors of success in the dental implant treatment are related to the training of surgeons, the design of implants, the intra-operative control of implant placement, the consideration of the occlusal loading and the long term maintenance.

It is of paramount importance that dentists or dental specialists should attend dental implant continuing educational courses or dedicated diploma or master degree courses. Training can significantly reduce most of the intra-operative errors and equip the dentists with the skill of managing complications if they ever happen. The design of implants has improved a lot by research on the coating of the dental implants that increases the ratio of bone to implant contact; the configuration of implants in achieving better primary stability that is so critical to the osseointegration process; the range of prosthetic abutments that can handle any implant mal-alignment. The intra-operative control of implant placement is much better by the refinement of drilling machines in controlling the drill speed and torque control in reducing the overheating of the bone surrounding the implants; the control of water irrigation or the availability of internal implant

irrigation systems in further minimising the rise in bone temperature; the sharpness of drills by having more disposable drills being available; custom-made surgical splint in defining the implant location and angulation based on CT data rather than plain radiography.

The dentists and prosthodontists are more conscious of the occlusal loading on the dental implant prosthesis. In Hong Kong, most patients demand for dental implant fixed bridges and that require good precision in dental implant alignment and the implants to be linked up in triangular configuration in enhancing the stability of the implant support bridges to resist from the lateral displacement forces. The choice of acrylic, porcelain or newer materials depend on both the occlusal loading and aesthetic requirements.

Long term maintenance of dental implants is gaining importance as the main factor affecting the long term prognosis of dental implants. Patients should be well instructed in maintaining oral hygiene around the dental implants. A lot of implant cleansing aids are more widely available in line with the growing demand of dental implants. The presence of attached gingiva is being recognised as important for the maintenance of good oral hygiene in reducing the incidence of periodontal disease around the implants (peri-implantitis). The patients are better informed in committing to regular oral hygiene visits every 6 months and annual check-up with either the surgeons or the prosthodontists.

### Peri-implant surgery

The loss of teeth will result in a concomitant resorption of the alveolar bone and with time, there may be insufficient bone height or width for the placement of implants. That is when the peri-implant surgeries come in [??and this is being increasingly known adequate implant length and width are important to improve the longevity of dental implants]. Various bone augmentation methods from simple onlay bone graft for small depression, inlay bone graft for sandwich osteotomy to the maxillary sinus floor augmentation are being taught to dentists or surgeons in enhancing the bone volume.

When there is a lack of soft tissue due to atrophy or from ablative surgery, vestibuloplasty and palatal



graft transplant are gaining wider acceptance. The use of free gingival graft transplant has been developed recently in our discipline and was found to be technically easier and produced less morbidity to the patients. Different peri-implant surgeries may be combined in addressing the problems related to either the bone or soft tissue deficiency around the implant placement and in implant maintenance.

## Development in image guided implantology

Image guided implant placement has undergone revolutionary development in the last five years. There are essentially two main types of image guided implant surgery. Both types involve the implant planning on dedicated softwares to define the position and angulation of the implants to be placed, the avoidance of contacting the inferior alveolar nerve or the intrusion into the maxillary sinus. The difference is one is a real time navigational implant surgery whereas the second one is the insertion of implants with the use of a stereolithographic surgical splint. Both systems have benefits and drawbacks.

The benefits of the real time navigation is that the implant placement is being guided via computer on-screen guidance and intra-operative adjustment can be made if the implant position in bone is found to deviate from the computer planned position (Fig. 1). The drawbacks are the expensive machine and long calibration time that makes the productivity not very economical. The system is good for teaching centre as training tool rather than being used in busy clinics. In contrast, the computer designed surgical splints enhance the speed of implant placement tremendously. Two systems are widely used in Hong Kong and they are the Nobel Guide (Fig. 2) and Materialise SimpDent. In the Nobel Guide system, the time for placement of six implants with fitting of pre-fabricated temporary bridge on a maxilla can be done within one hour and a patient can return back to normal diet with minimal swelling is a big step forward. The drawback is that if there is any error in the computerised planning or splint fabrication, the surgeons cannot make any intra-operative adjustment unless the surgeons abandon the use of the splint at all and the implants will ultimately be wrongly placed.

## Extension of scope

In addition to the placement of the dental implants on the alveolar bone, very long implants of 40-55mm are available to insert through the palatal bone to the zygoma. These zygomatic implants are extremely reliable and with the advantage of avoiding any sinus grafting and bone graft.

Implants can be placed extra-orally for supported facial or ear prostheses. With the navigational surgery, this will enhance the accuracy of implant placement. Research is being undertaken to apply computer aided design and computer aided manufacturing method for facial prosthesis construction.

## Future development of dental implantology

Tremendous amount of implant researches are being done and there are a few dedicated international dental implant journals with good impact factors available. Product improvement such as the coating of the implants with bone growth factors are being actively researched in an attempt to increase the speed of implant osseointegration and to enhance the longevity of the implants.

Research in substituting the titanium material with ceramic is being pursued in order to reduce the exposure of the metallic implant body above the gingival level. This is to a certain extent being improved by the recently developed zirconium material, which is opaquely white and extremely hard and is a suitable material for the abutment construction. A material of better translucency is recently available and is composed of alumina but is considered too brittle for posterior bridge construction. There is little doubt for further search of a biological compatible material simulating the tooth colour for dental implants. We hope that this will not be too long before the opportunity of tissue engineered teeth by cell culture methods.



Fig. 1: Real time navigation of dental implant placement with the Image Guided Implantology system

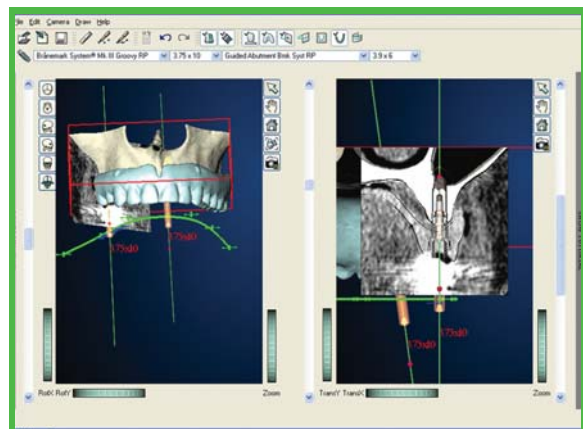


Fig. 2: Implant planning on maxilla using the computer software of Nobel Guide