Introduction

Edentulism is a worldwide health issue. This case describes how treating a fully edentulous patient with computerised digital planning (coDiagnostiX and Straumann Guided Surgery) can lead to precise 3-D implant positioning and an optimised prosthetic outcome.

Initial situation

A male patient aged 59 presented with a previously fabricated maxillary overdenture and failing maxillary and mandibular dentition (Fig. 1). The patient requested a conventional removable prosthesis for the maxillary arch and a fixed option to replace his mandibular dentition. His previous maxillary overdenture had poor retention and was planned to be remade. Full-arch extractions were completed three months prior to implant placement. An immediate denture was fabricated and delivered on the day of the extractions.

Treatment plan

The treatment plan involved the placement of five Straumann mandibular implants to support a fixed hybrid
prosthesis. Four of the dental implants were to be used for the provisional fixed prosthesis to attain cross-arch stabilisation during osseointegration. The patient was referred for a CT scan using a dual-scan protocol with coDiagnostiX (Figs. 2–4). The virtual planning strategy was to bypass the mandibular canals and mental foramina and make use of all available bone by using a predictable procedure that was simple and affordable for the patient. Once designed, the guide and prosthesis STL files were imported into a separate CAD programme to design the occlusal fixation guide. Both the surgical guide (Figs. 5–7) and the occlusal fixation
guide (Fig. 8) were fabricated using additive manufacturing techniques.

Surgical procedure

Bilateral local anaesthesia was administered. The vertical dimension of occlusion was measured extraorally using a Boley gauge with facial landmarks on the patient’s nose and chin. The occlusal fixation guide was positioned opposing the patient’s maxillary conventional denture and verified with polyvinylsiloxane (PVS) bite registration (Figs. 9–12). While the patient was in centric occlusion, four 1.3 mm diameter osteotomies were created in the labial plate through the alveolar mucosa using the Straumann template fixation drill (Figs. 13 & 14). The surgical guide was removed, and crestal incisions were made bilaterally, extending to the external oblique ridge. Distal releasing incisions and an anterior releasing incision 4 mm to the left of the midline were made (Figs. 15 & 16). After full-thickness flap reflection, the mental foramina and neuromuscular bundles were visualised and isolated (Fig. 17). The surgical placement guide was inserted and
stabilised using four 1.3 mm diameter Straumann temporary fixation pins (Fig. 18). Sequential osteotomy preparation was completed to depth through Straumann 5 mm T-sleeves at each site using the Straumann Bone Level Tapered (BLT) fully guided surgical kit (Figs. 19–21). After removal of the surgical placement guide, alveoloplasty of approximately 5 mm was completed (Fig. 22). Restorative space, osteotomy depth and avoidance of vital anatomical structures were verified. Two Straumann BLT SLActive implants (RC, 4.1 mm in diameter, 10 mm in length) were placed at sites #35 and 45. Two Straumann BLT SLActive implants (RC, 4.1 mm in diameter, 12 mm in length) were placed at sites #32 and 42, and a single Straumann BLT SLActive implant (RC, 4.1 mm in diameter, 8 mm in length) was placed at site #31 (Figs. 23 & 24). Straumann angled screw-retained abut-
ments were torqued to 15 Ncm, and sites with thin labial bone around the implant were grafted with autogenous bone as needed. The flaps were repositioned and sutured with 4/0 chromic gut (Figs. 25 & 26).

Restoration procedure

After implant placement, the mandibular complete denture was reinserted with fast-set PVS material placed on the intaglio surface to indicate implant location (Figs. 27–30). Space was made for the temporary copings, the healing caps were removed and Straumann RC temporary copings were placed on implants #35, 32, 42 and 45 (Figs. 31–33). Copings were torqued to 15 Ncm, and the occlusion was adjusted to have uniform contacts in centric relation and balanced occlusion in excursive movements.

The prosthesis was converted from the pre-existing conventional complete denture to an interim fixed detachable prosthesis by reducing the flanges and providing adequate hygiene space (Figs. 34 & 35). Occlusal screws were torqued to 15 Ncm, and the occlusion was adjusted to have uniform contacts in centric relation and balanced occlusion in excursive movements.

The screw access holes were filled with extra-light viscosity PVS material (Fig. 36). A postoperative radiograph was taken after delivery of the prosthesis (Fig. 37).

Outcome and conclusion

Utilisation of the template fixation pins was an essential step in transitioning the mucosa-borne occlusal guide to a secure bone-supported guide. The pins are designed to ensure the digitally planned guide is in the correct surgical position to provide a restoratively driven outcome. In this case, the virtual planning models and the actual outcome demonstrated that the Straumann Guided Surgery system provides a high level of precision for the purposes of implant positioning.

about

Dr Phillip Garrett obtained his dental degree from the School of Dentistry at the University of Texas Health Science Center at San Antonio in the US in 2015. After graduation, he remained in San Antonio and immediately began specialty training in the graduate periodontics department. He is currently in his third year and plans to begin working in Phoenix in the US after receiving his certificate in periodontics in May. He is actively involved in clinical research, with a focus on implant surface topography and nanotechnology.

Dr Kyle Trobough is a second-year resident in the graduate periodontics department at the School of Dentistry at the University of Texas Health Science Center at San Antonio. He graduated with a DDS in 2016 and immediately began specialty training in the graduate periodontics department. He received a BS in mechanical engineering from Southern Methodist University in Dallas in the US. His interests include digital implant dentistry and merging CAD/CAM processes with a digital dentistry workflow.

Dr Ryushiro Sugita is a third-year graduate prosthodontics resident at UT Dental in San Antonio. He received his DDS from Tokyo Medical and Dental University. After dental school, he enrolled in the residency programme in the Department of Geriatric Dentistry and gained experience in major reconstructive procedures. After practising for number of years in Japan, he entered the Graduate Prosthodontics Program at UT Dental in San Antonio.

Dr Anna Pitz is a second-year graduate prosthodontics resident at the School of Dentistry at the University of Texas Health Science Center at San Antonio. Prior to residency, she graduated with a DDS in 2016 from Virginia Commonwealth University in Richmond and a BS in biology from Wake Forest University in Winston-Salem, both in the US.

Fig. 37