

The application of guided dental implant surgery in prevention of inferior alveolar nerve damage in a patient with compromised bone

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Introduction

Iatrogenic injuries to the inferior alveolar nerve (IAN) can impact significantly on patients' lives. Altered sensation and pain in the oro-facial region may interfere with speaking, eating, kissing, shaving, applying make-up, tooth brushing, drinking and just about every social interaction.¹

IAN injury is the most problematic consequence of dental surgical procedures and has major medico-legal implications.²

Causes of inferior alveolar nerve injury include placement of dental implants, local anaesthetic injections, third molar surgery, endodontics, trauma and orthognathic surgery.

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Case History

A healthy 53 year old female patient presented with a collapsed occlusion. Main complaints were difficulty in chewing, aesthetic dissatisfaction and a desire not to lose more teeth. Function was limited to the 7 anterior teeth with no posterior support (Fig 1-3). . Loss of posterior occlusion may result in the loss of neuromuscular stability of the mandible, temporomandibular joint (TMJ) dysfunction, reduced masticatory efficiency, loss of vertical dimension and poor aesthetics. Rehabilitation should aim to address all of these concerns.

Further complications were lack of attached keratinised

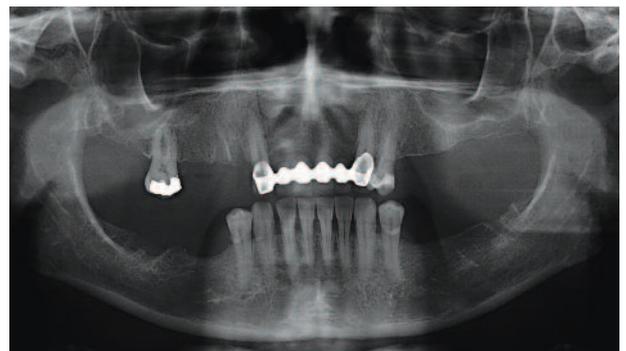


Figure 1: Preoperative panoramic radiograph



Figure 2: Preoperative view maxilla



Figure 3: Preoperative view mandible

tissues and reduced mandibular alveolar ridge volume. Keratinised attached tissue, although a contentious topic, may have long term benefits with regards to plaque control at the implant site.^{3,4}

This case highlights multidisciplinary comprehensive treatment planning of a complex case using cone beam computed tomography (CBCT) and computer-designed surgical guides.

The ITI SAC Assessment tool determined this case as complex.

Methods and Materials

A diagnostic wax-up determined the final 3D result that could be achieved in both arches. A CBCT revealed a very thick lingual cortex with poor cancellous bone and close proximity of the mental foramina in planned positions 35 and 45. Simplant Pro® (Materialise Dental®) was used to

create the 3D representation of the anatomical structures (Fig 4a&b).

A stereo-lithographic stent (Classic SurgiGuide®, Materialise Dental®) was printed from the final treatment plan. This guides the surgeon with the position and angulation of implant placement, but not placement depth.

A tooth-supported, Classic Surgiguide® was decided upon for the following reasons :

Due to the close proximity of the mental foramina to the planned implant sites in positions 35 and 45 and a very thick lingual cortex with almost no cancellous bone, it was planned that the implants would need to be angled towards the lingual cortex to avoid the mental foramina and the inferior alveolar nerve (IAN). It was anticipated that angling the implant lingually in a controlled manner would result in a slight deviation of the implant towards the buccal direction.

The implication of this is that the surgeon requires a guide

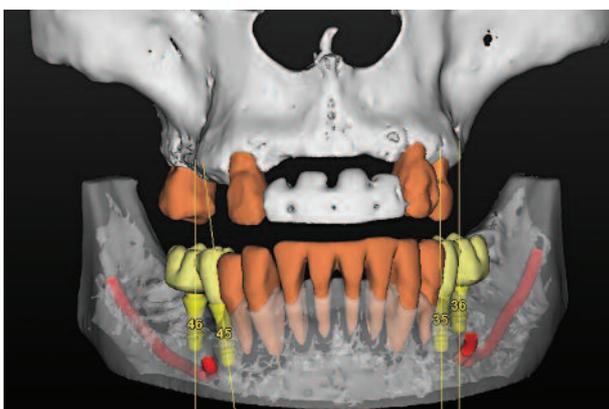


Figure 4a: Virtual implant planning

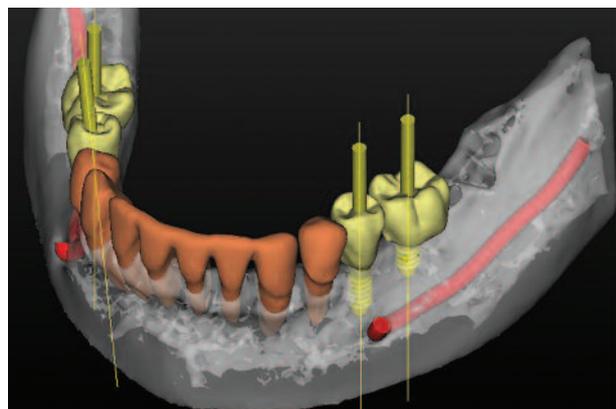


Figure 4b: Implants planned lingual to the IAN



Figure 5: Mandibular provisional crowns



Figure 6: Postoperative panoramic radiograph

with a degree of “play” which will allow him/her to make corrections during surgical placement of the implants.

The lack of attached keratinised tissue was addressed by performing bilateral mandibular vestibuloplasty procedures and free gingival grafts.

Roxidid®, Straumann® tissue level implants were placed with a 2mm safety zone between implant and nerve.⁵ Two 3.3 x 10mm implants were inserted in the 35 and 45 sites and two 3.3 x 8mm implants in the 36 and 46 sites using the Classic SurgiGuide®. Roxidid® is 50% stronger than pure titanium and shows improved integration with bone and is thus ideally suited for reduced bone situations.⁶ Provisional implant supported crowns are shown in Figure 5. Maxillary implants were subsequently inserted as planned (Fig 6). No post-operative nerve fall-out or complications were experienced.

Table 1: Results of Data Set Mapping

	Angular deviation (degrees)	Lateral deviation (mm)
Implant 46	4,9956	1,4608
Implant 45	2,5615	0,3925
Implant 35	7,6647	0,2229
Implant 36	3,5797	1,0744

Data Set Mapping

A postoperative CBCT was taken and mapped with the preoperative scan to determine the correlation between planned and final implant positions (Table 1). Angular deviations of this case are within the expected deviations for Classic SurgiGuide® systems.^{7,8} The postoperative CBCT mapping of the planned and eventual positions of the implants are shown in Figure 7.

Conclusions

The preoperative planning and use of a surgical guide was beneficial in this case as it provided knowledge of the exact location of the mental foramina, IAN, alveolar ridge dimensions and the quality and quantity of bone available. This case demonstrates the importance of correctly diagnosing complex cases using the ITI SAC Assessment tool.

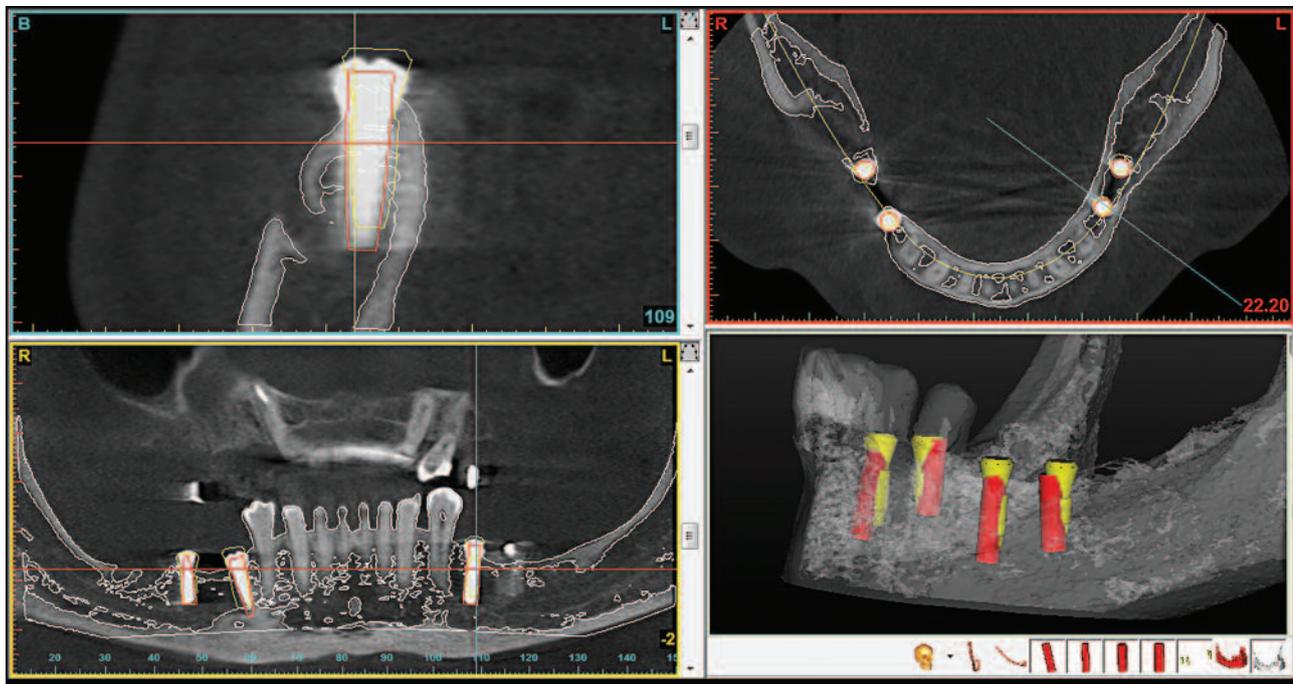


Figure 7: Angular deviations demonstrated with mapping. Yellow: Planned implant position. Red: Final implant position

The only alternative to this treatment would have been bone block augmentation in the area of the mental foramen, a procedure too risky to undertake.

Complications with such complex cases can significantly impact the lives of patients and should be approached with extreme caution by experienced clinicians only.

Acknowledgements

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