

Think twice before you think implants

Adam Patel provides an invaluable insight into gold-standard treatment planning for dental surgeons wishing to embark on a career in implant dentistry

The world of implants is fascinating. It's a realm where you incorporate knowledge procured through years of studying the plethora of disciplines within dentistry, with the aspiration of achieving a beautifully harmonious symbiotic result resembling nature.

But how do you get there? Certainly not straight out of dental school and unequivocally not by partaking on an accelerated short winded implant course. Take heed my dear colleagues, as there is an abundance of pitfalls and hurdles littered along the alluring path to this utopia.

The key to achieving success in this discipline is to consolidate knowledge and nous accrued by gaining a thorough understanding and respect for the disciplines of periodontology, oral surgery, restorative and prosthodontics. Elements of each of the aforementioned disciplines need to be attended to during the treatment planning phase in order to formulate a coherent and predictable plan.

Treatment planning is the key to success in placing implants. Copious measures of planning are necessary, though this strategy rings true for most disciplines the results can be devastatingly more reprehensible if things go wrong with implants. Focussing on a real case study I will provide an insight into the various aspects that require particular attention to detail during the planning phase.

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Figure 1: LR6 ridge before (left) and after (right) placement of implant restored with an Atlantis CAD/CAM abutment retained crown

Patient history

Patient: Female, age 42.

C/O (complaining of): Would like to replace missing LR6.

HPC (history of patient complaint): LR6 extracted approximately four months previous due to periapical infection.

Extraction status: Extracted whole with uneventful healing.

PDH (previous dental history): Regular attendance.

MH (medical history): The American Society of Anesthesiologists (ASA) 1, fit and well, no previous medical conditions and taking no prescribed medications. No known drug allergies.

SH (social history): Non-smoker and does not drink alcohol.

Primary expectation: Improve masticatory function.

Secondary expectation: Improve mandibular aesthetics.

It is imperative to ascertain a thorough patient history from the outset. Detailing the history stimulates a dynamic thought process and is the prelude to formulating a treatment plan. The time lapse since the tooth was extracted,

the reasons and the manner of extraction are essential as it allows you to gauge the likelihood of pathophysiological and physiological bone loss at the projected implant site. In this particular case, the tooth was extracted within four months of presentation as a result of periapical infection. Thus, the patient is still within the ideal time-frame for a conventional delayed placement protocol (more than three months post extraction) whilst still being within a six month post-extraction window where marked bone resorption begins to obviate.

The manner of extraction often indicates the likelihood of bone loss. An uneventful whole extraction with no buccal plate loss is a more favourable scenario than an extremely difficult surgical removal with potential root remnants maintained within the sockets. As a general rule, a socket with acute periapical infection would ideally require a slightly longer healing phase prior to implant insertion.

There are a multitude of medical conditions that can conversely affect implant therapy including diabetes, a history of radiotherapy and a variety of bone pathosis. Other medical conditions can have secondary effects however the three aforementioned groups are crucial and need to be highlighted. It can be useful to use the ASAs' classification to summarise the medical status.

Social history is another essential component. Smoking and alcohol consumption can both alter patient healing whilst smoking particularly has been shown to have a direct effect on implant osseointegration and long-term success rates.

It is invaluable to gauge the patient's treatment objectives to ensure the plan you

Figure 2: Lip line classification



High

Medium

Low



Figure 3: Right buccal view



Figure 4: Anterior intercuspal view



Figure 5: Left buccal view



Figure 6: Occlusal view upper arch



Figure 7: Occlusal view lower arch



Figure 8: Mounted study models on a semi-adjustable articulator

formulate achieves a satisfactory clinical outcome whilst meeting the patient's expectations.

Extraoral examination

- **Lymph nodes:** Nothing abnormal detected (NAD)
- **Temporomandibular joint:** NAD
- **Muscles of mastication:** NAD.

As with any routine examination the above extraoral structures should be assessed with any abnormalities noted.

- **Maximum vertical opening:** 40mm
- **Smile line:** Low
- **Lip line at rest:** Incisal 1/3.

The maximum vertical opening is an important consideration especially when working in the posterior quadrants of the mouth. The vertical opening will help determine the degree of difficulty with access when performing surgery, as well as help plan the impression technique and restorative approach. A vertical opening of 40mm as with this case would be considered average and provide adequate access to the posterior quadrants.

The smile line can be defined as low, medium or high as demonstrated in Figure 2. This is an important consideration when placing implants in the anterior aesthetic zone with the complexity of the case and importance of soft tissue configuration increasing with increased height of the lip line both at rest and whilst smiling.

Papillae height and position becomes imperative with a high lip line to avoid unsightly 'black triangles' from developing interdentally.

Intraoral examination

- **Soft tissue:** Healthy – NAD

- **Oral Hygiene:** Good, patient flosses daily
- **BPE:** 0 0 0
0 2 0
- **Gingival biotype:** Thick
- **Tooth form:** Triangular
- **Bruxist:** No; restored cervical lesions indicative of potential previous history of interferences
- **Caries risk assessment:** Low
- **Periodontal risk assessment:** Low
- **Mobility:** Nil.

Healthy soft tissues and good oral hygiene are imperative components for implant therapy for obvious reasons.

The patient's gingival biotype can be determined by both physical and visual methods. A firm, well stippled flattened contour usually indicates a thick biotype. This is well demonstrated in Figure 5. This can have a bearing on the type of flap raised, as a thick biotype will usually heal more efficiently but is also more likely to scar. A thicker biotype is usually associated with reduced papillae height and a wider band of keratinised tissue.

The tooth form is important when considering the restorative aspects of the treatment. Square teeth are easier to replicate as they often have a wider contact point with reduced papillae height, whilst triangular teeth have a narrower contact with increased papillae height as noted in Figure 4. This is particularly important to note when planning multiple implants that may be positioned adjacent.

Occlusal considerations

- Angles class I

- Class I incisor relationship
- Overbite: 1mm
- Overjet: 2mm
- Crossbite involving LR2/LR3 and UR2 (Figure 3)
- Group function right and left side
- No non-working side interferences
- Slide from retruded contact position to intercuspal position. Large vertical component; small horizontal component (Vh).

Bruxism is an extremely important consideration as the need for correct occlusal loading and the absence of interferences on the implant restoration becomes even more paramount in these patients. The occlusal scheme on implant restorations should be tailored to each individual case. In this particular case, with no signs of active bruxism we shall follow the occlusal principles of implantology in that the cuspal inclines will be set to a shallow 30° whilst ensuring the occlusal load is maintained in the central fossae region (Figure 1).

The patient's lateral excursions occur in group function due to a lack of canines and this occlusal scheme will be maintained as the patient has no current indications of disharmony. However, we shall avoid any lateral excursive movements on the implant restoration.

Facebow records are taken followed by mounting the models on a semi-adjustable articulator as demonstrated in Figure 8. This step is essential in scenarios where potential occlusal issues may be encountered.

Special investigations

Bitewing radiographs:

Bitewings provide an overview for caries

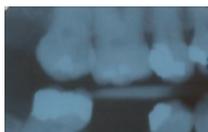


Figure 9a: Right bitewing radiographs



Figure 9b: Left bitewing radiographs



Figure 12: Intermaxillary space measuring 9mm

assessment. In this particular case bitewing radiographic review (Figures 9a and 9b) shows secondary decay present in the UL5, a disto-occlusal cavity in the LL6 and large sound restorations present in both teeth adjacent to the potential implant site. Ideally, all restorative treatment should be accomplished prior to implant placement.

Cone beam computed tomography scan (CBCT):

A CBCT is indicated in situations where vital anatomical structures are in close proximity to the planned implant site. In this particular scenario, an LR6 implant is being planned, thus the rationale for a CBCT scan is the proximity of the inferior dental nerve and a potential mandibular lingual undercut.

The red markers on the slices (Figure 10) indicate the position of the inferior dental nerve. Measurements can be taken from the nerve position to the bone crest to evaluate the height of bone present. It would be prudent to maintain a 2mm safety distance between the base of the implant and the inferior dental nerve to account for any potential inaccuracies. In this particular case I measured approximately 15mm bone height and a shallow bony undercut lingually.

Implant site measurements

- Adequate attached gingivae present (Figure 11)
- Approximately 2.5mm mid-buccal recession present
- Mesio-distal: 10mm (Figure 11)
- Bucco-lingual: 7mm (Figure 11)
- Intermaxillary space: 9mm
- Low aesthetic demand
- Good inclination of adjacent teeth.

Ideally, 1.5mm distance is required between the implant circumference and the adjacent tooth, whilst a minimum of 1mm is required

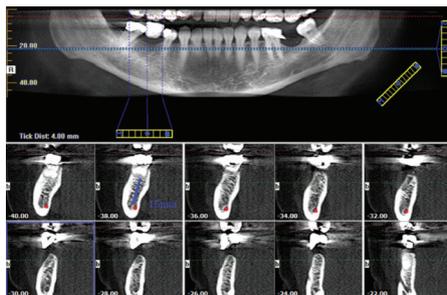


Figure 10: Patient CBCT showing 10 slices in the LR6 region



Figure 13: Casted study models

buccal and lingual to the actual implant. The intermaxillary height (Figure 12) is an important factor to ensure sufficient height for the combination of abutment and restoration.

Study models and diagnostic wax ups

A diagnostic wax-up (Figure 14) provides the patient and clinician with an insight of the finished restoration. This stage is imperative in the aesthetic zone, but can also prove invaluable in other areas of the mouth.

Surgical stent

The surgical stent demonstrated in Figure 15 is created to aid in the ideal positioning of the implant in relation to the prosthetic envelope.

Diagnosis, treatment options and aim of therapy

Finally we can conclude our diagnosis:

- Secondary decay UL5 disto-occlusal (DO)
- Cavity LL6 DO (non-carious)
- LR6 space present.

To attain informed consent we are required to provide the patient with all treatment options relating to the site in contention:

- Leave space in LR6 region
- Removable prosthesis to replace missing LR6
- Fixed prosthesis to replace missing LR6
- Single implant restored with crown.

In conclusion the aim of the therapy in synchronicity with the patient's wishes is to restore the LR6 space with a single implant and crown.

Having conducted a thorough and systematic planning phase with a series of special



Figure 11: Mesio-distal and bucco-lingual measurements



Figure 14: Diagnostic wax-up LR6



Figure 15: Surgical stent LR6

investigations I can now safely and predictably execute the surgical step of the treatment followed by a restorative phase that should achieve the initial aims and objectives of our treatment goal (Figure 1). In my experience, a rigorous treatment planning process frequently requires more time in comparison with the actual execution of the treatment.

This brief insight will hopefully enlighten dental surgeons to the copious cognitive steps involved in the treatment planning of implants whilst improving your understanding of why such steps are pivotal. The time expended is invaluable in that it allows us to both prepare for and eliminate potential hurdles that may present during the odyssey culminating in attaining that utopia where we seamlessly connect mechanics with nature to achieve blissful harmony. **YD**

