

Minimal tissue loss using dual zone grafting in an implant restored smile

Richard Coates explains how he helped to give a patient her smile back after an alleged assault



Dr Richard Coates BDS Pg Dip CID - Is a private dentist working at Riveredge Cosmetic Dentistry, Sunderland. He is chairman of North East Private Dentists and is currently in the middle of the accreditation process with both the BACD and AACD. He travels Within the U.K. and to the USA yearly to further his skills and loves his dentistry.

I treated this case in my practice 13 months after successfully completing the Newcastle University (UK), postgraduate diploma in clinical implant dentistry in December 2017.

I had carried out a little implant dentistry prior to attending the programme and what I wanted was a university implant qualification grounded in evidence, with one-to-one clinical teaching on all stages of implant treatment.

I also wanted the patients to be provided by the organisers.

The course, which used Nobel Biocare implants, was rigorous with various kinds of assessment at all stages.

This gave me a real sense of achievement, and allied with the clinical experience, confidence in taking my implant dentistry to a new level.

I made some great new lifelong friends with both my fellow students, who were at various stages of the implant training journey. And with the tutors, who were incredibly helpful and supportive throughout.

The formalised training was exceptional, which made me realise how inadequate some of the short-training courses I had attended prior to my university diploma had been.

It really challenged me and I absolutely loved every day I spent at the Newcastle Dental School.

Introduction

An alleged assault which results in avulsion of UL1 and sub-gingival root fracture of UR1 can feel like a life-changing event.

This young woman was 24 years of age and the loss of aesthetic appeal to her smile was particularly upsetting.

Following an emergency denture placement by her regular dentist, she was referred to me to discuss her options. Her particular interest was an implant solution.

Her regular dentist was unsure how to rectify the significant tooth and tissue loss. Especially with regard to complete loss of the papilla between the central incisors (Figure 1).

History

When the patient attended her first visit, she told us that she had been on a night out. Whilst standing in a taxi queue, she ended up getting hit by a shoe, which knocked UL1 out and fractured UR1 below the gum level.



Figure 1: This photo shows the damage caused due to the alleged assault. It shows the gingival level with maximal smile. The potential tissue-restorative junction is just at maximal smile level. It also shows loss of the papilla between the central incisors

The avulsed tooth was lost down a drain.

This young woman had been informed that implants or a conventional fixed/fixed bridge would be her best fixed options, with consideration also given to resin bonded bridgework.

However, due to tissue loss, a pleasing aesthetic result may be difficult.

Nevertheless, I felt that if we could retain tissue still present then a good result could be created.

The area of trauma was asymptomatic. The patient's immediate concern was that the denture she had been provided with (Figure 2) did not represent the pre-trauma appearance.



Figure 2: Denture at presentation



Figure 3: Mock-up of idealised morphology

She said her teeth did stick forward slightly and were bigger than on the denture.

On the first visit therefore, I bonded composite to the existing denture teeth until she was happy that the appearance was as close as possible to the pre-trauma situation (Figure 3).

The UL1 area had lost some vertical and horizontal tissue height after the tooth was avulsed, and the retained root at UR1 was unrestorable.

We must thank the referring dentist for retaining this root in order to preserve bone until definitive treatment could be delivered.

Adjacent incisors were unharmed in the accident and responded to pulp testing.

I felt that I could re-create the morphology of the lost teeth using a cantilever implant retained restoration. Research has shown that implant-to-pontic gives the best possible papilla preservation (Salama et al, 2008) in comparison to implant-to-implant.

In this case this would allow minimal use of pink prosthetic in the definitive restoration. Radiographs showed a short, previously root-filled root at UR1.

Our patient, although being somewhat averse to surgery, requested the implant option after extensive discussion of all possibilities.

I explained that placing an immediate implant (type 1 placement) would reduce surgical visits (Buser et al, 2017). Though fraenectomy was advised to avoid potential aesthetic issues, the patient would not consent to this.

In order to reduce tissue loss and control the surgical area I decided to use the dual zone grafting technique (Chu et al, 2017).

Medical history

Non-smoker. Nothing abnormal discovered and no medications taken.

Dental history

The patient had a lightly restored dentition and good oral hygiene (LL8 and LR8 were partially erupted).

No active pathology was found.

LR1 and LR2 also sustained enamel fractures in the trauma and required restoration.

Social history and financial position

The patient's lifestyle and finances (self-financing) allowed for treatment and regular reviews in order to make long-term success a reality.

The patient was happy with the treatment plan and costs and was available for visits required to ensure ongoing maintenance.

Full clinical examination

Soft tissues: NAD.

Teeth:

- Well-maintained dentition with no caries. Low caries risk
- LR1 and LR2 with incisal enamel fractures and UR2 with small MI enamel fracture
- No incisal wear, as anterior open bite present.

After seeing her mock-up on the provisional denture, the patient consented to treatment being carried out with a view to mimicking this morphology.

She was aware that due to loss of soft tissue we would have to add some prosthetic gingiva at the central papilla area.

Periodontium:

- Good oral hygiene
- Minimal calculus in lower arch
- No bleeding on probing
- Gingival biotype - medium.

BPE (British Periodontal Examination) – 1/1/1 upper 2/2/2 lower.

BEWE (British Erosive Wear Examination) – 1/1/1 upper 1/1/1 lower.

Mild generalised gingivitis. Hygiene visit advised. Periodontal risk assessment – low.

Occlusal assessment

- No history of headaches or TMD symptoms
- No history of trauma to jaws (only incisor)
- No history of pops or clicks from the joints
- No history of grinding, wear or parafunctional habits
- Anterior open bite
- Even simultaneous bilateral contacts posteriorly
- No constricted anterior envelope of function
- Slight skeletal class 3.

Patient deemed to have a stable occlusion, with acceptable function.

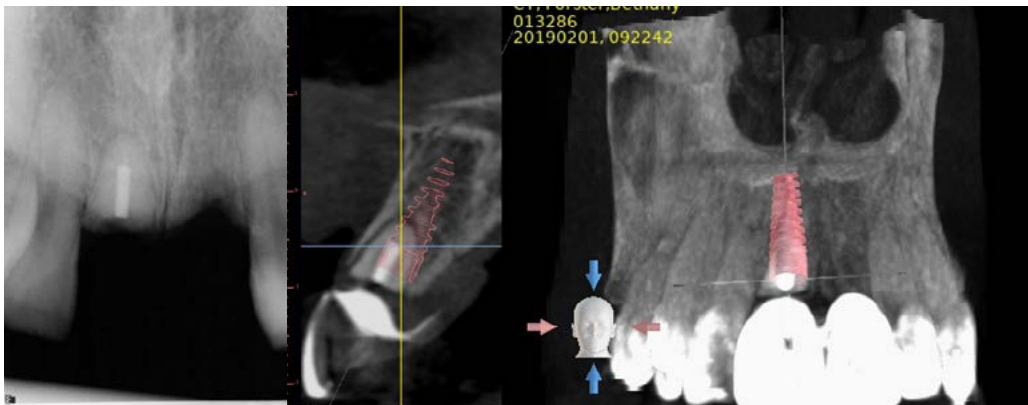


Figure 4: Radiograph and CBCT with simulated implant placement planning

Radiographs

Periapical and bitewing radiographs were taken: bitewings – NAD, periapical radiograph – UR1 root remnant with previous RCT.

A CBCT was obtained with the modified denture in place, used as a radiographic guide for implant planning. It showed an intact buccal plate of approximately 1mm thickness at the level of the prosthetically-driven proposed implant head position, and sufficient bone volume for immediate implant at UR1 (Figure 4) (Guerrero, Noriega and Jacobs, 2014).

Diagnostic process

Patient attended for aesthetic reasons post trauma. She wished to have a fixed option. Therefore, our remit was very clear from the beginning.

A full set of diagnostic photos and appropriate radiographs were taken with CBCT.

Occlusal examination suggested no problems.

Clinical examination revealed no significant mobility of teeth, a missing UL1 site, which was healing and a root fracture at UR1.

Patient reported that she was not confident in social situations with her post-trauma provisional denture.

Upper incisors have an anterior open bite (reducing potential forces on definitive restoration, allowing use of a single implant to support both central incisors).

Moderate smile line, soft tissue-prosthetic transition not visible.

Patient requests replacement teeth to be dominant and slightly labial to lateral incisors.

Short UR1 fractured root filled root would require extraction.

Given that our patient rejected multiple surgical options and wanted the most conservative implant option, I decided to retain as much tissue as possible using immediate implant placement with dual zone xenograft grafting (Chu et al, 2017) (see below).

Diagnosis and assessment

1. Avulsed UL1 and healing socket
2. Fractured unrestorable retained root UR1
3. Complete loss of central papilla and pronounced frenum
4. Emergency denture with small teeth and sub-optimal fit
5. Incisal enamel fractures to LR1 and LR2
6. Mild gingivitis.

Initial management was centred on mocking up the potential achievable appearance on the patient's denture and obtaining the patient's consent to proceed.

All options were itemised and were discussed with the patient.

The colour/shade of the patient's teeth was assessed in natural light to be primarily B1 Vita.

Consent

1. Prognosis of dentures, bridges and implants discussed with patient. Longevity explained to patient along with requirement for maintenance
2. Replacement of definitive restoration would eventually need to be carried out as dental treatments do not last forever. The patient was happy to consent to this
3. After discussion of advantages and disadvantages of all treatment options and possible improvement of soft tissue, the patient declined the option of frenectomy and soft or hard tissue grafts that would have required lifting of a surgical flap, as she wished to minimise the extent of surgery as much as possible
4. Patient understood that good oral hygiene would be imperative
5. It was explained that it is difficult to match the colour of ceramic perfectly to the adjacent incisors using a non-biological material. Again, the patient was happy to go ahead with this potential compromise on the basis that her new implant-borne prosthetic teeth would have the morphology provided by the mock-up
6. Patient consented to use of all potentially required non-human graft materials.

Treatment plan summary

1. Full examination, medical, dental and social history recorded, along with patient expectations of treatment and radiographs (including CBCT)/photos
2. Hygiene
3. Direct composite mock-up bonded to interim emergency denture agreed with colour analysis. Limitations explained and patient consent and financial agreement reached
4. Provision of surgical guide and guide try-in
5. Minimal trauma extraction of UR1 root, placement of 13mm RP Nobelreplace tapered CC implant with xenograft to be placed into void around implant and also into soft tissue void around healing abutment. Provision of customised gingival level healing abutment. Modification of denture to begin grooming soft tissue at UL1 for an ovate pontic
6. Review at one week

7. Restore fractured mandibular incisor teeth with composite resin
8. Three months post-surgery, confirm osseointegration and utilising a temporary abutment, fabricate a custom screw-retained cantilever bridge with further development of UL1 ovate pontic site. Utilisation of this custom provisional bridge also allows us to confirm patient satisfaction with the morphology of the prosthetic teeth
9. Major impressions for definitive angulated screw channel (ASC) zirconia cantilever bridge utilising a customised impression coping to replicate UR1 developed emergence profile and UL1 ovate pontic site
10. Implant retained bridge fit with photos and maintenance instructions
11. Maintenance plan.

Operative procedure and completion of treatment – visit one

Mock-up of idealised UR1, UL1 so patient could visualise the end result to obtain consent (Figures 2 and 3), was carried out using B1 (SDI-Rok) bonded to provisional denture (patient presented with).

Denture was sandblasted first (Prepstart – Danville).

Flowable composite resin (Venus Diamond Flow – Kulzer) was used to modify the fitting surface of denture in order to begin grooming tissues with ovate pontic-guided pressure (Figure 5).



Figure 5: Ovate pontic-like modifications to denture in order to groom tissues

Patient rejected tooth whitening options. At this stage shade selection under natural light with tooth map was taken to be largely Vita B1.

Visit two

A laboratory-made, hard, tooth-borne solid acrylic surgical guide was fabricated.

A 2mm pilot hole was drilled, having studied the CBCT scan and planned simulated



Figure 6:
Surgical guide
try in

implant placement. The aim was to place an implant on a trajectory allowing for a screw retained restoration (Figure 6).

Visit three

Articaine 4% (1:100,000 epinephrine) local infiltration given at UR1 labial and lidocaine 2% (1:80,000 epinephrine) UR1 palatal.

The UR1 root was extracted using 15C blade, periostomes and a fine luxator to minimise trauma.

Granulomatous tissue was curetted and the buccal socket wall was confirmed to be fully intact with no dehiscence or fenestration.

A precision drill was then used in conjunction with a 2mm twist drill and the surgical guide in order to begin osteotomy preparation (Garber and Belser, 1995).



Figure 7:
Implant
placement
with surgical
guide used

The osteotomy was sequentially prepared allowing placement of a 13mm RP CC Nobelreplace tapered implant.

The insertion torque was 35Ncm demonstrating good primary stability.

The implant was placed with its head 4mm apical to the idealised free gingival margin position in order to respect 'comfort zones' (Buser, Martin and Belser, 2004) and allow sufficient space for an aesthetic emergence profile (Figure 7).

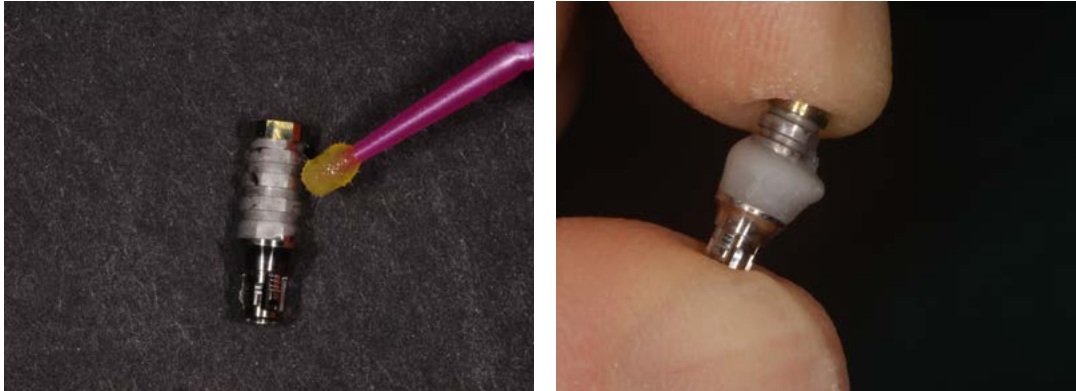


Figure 8:
A 'snap' temporary abutment customised using composite resin

Immediately following insertion of the implant, a customised temporary abutment was created (Figure 8). This would guide healing into an ideal emergence profile and also act as a seal for graft material.

Flowable composite resin (Venus Diamond flow) was placed, shaped and polished to a sandblasted temporary abutment and the abutment was then cut short in order to provide a gingival level abutment, which would minimise loading and allow accommodation of the denture during healing.

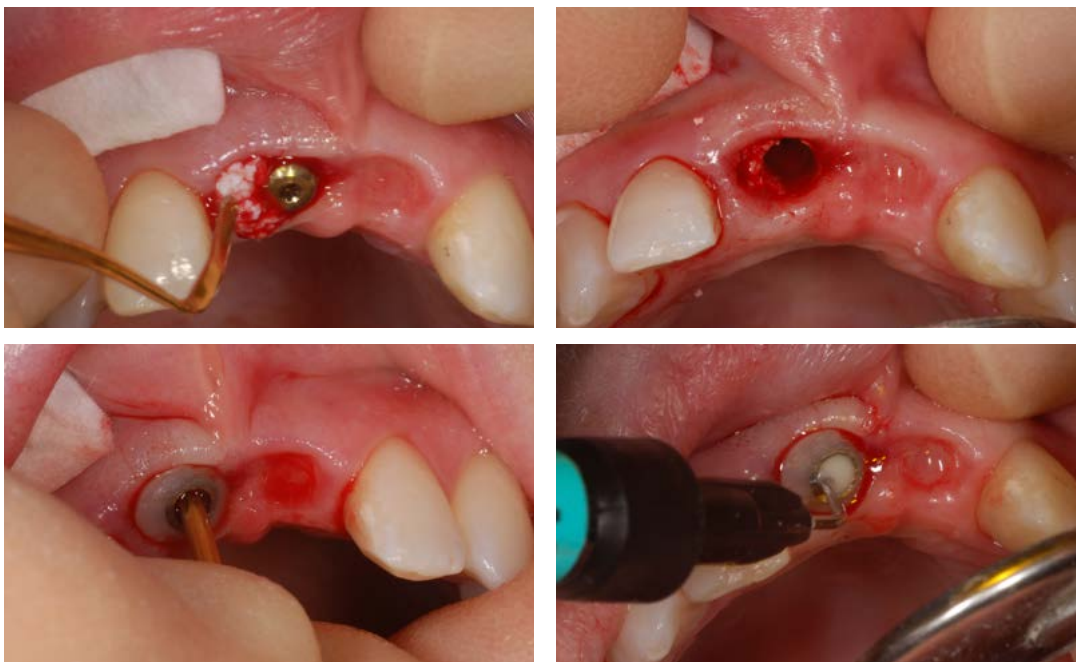


Figure 9:
Graft material packed around the healing abutment and clot allowed to form. Customised abutment then fitted to seal socket and screw hole closed with PTFE tape and flowable composite

A cylindrical standard RP healing abutment was then placed into the implant in order to protect the internal threads, whilst Nobel Creos Xenogain graft material was packed into the space between implant and buccal bone and also into the soft tissue zone.

After five minutes to allow blood clotting, the healing abutment was removed and replaced with the customised gingival level temporary healing abutment (Figure 9), sealing the surgical area and protecting the graft.

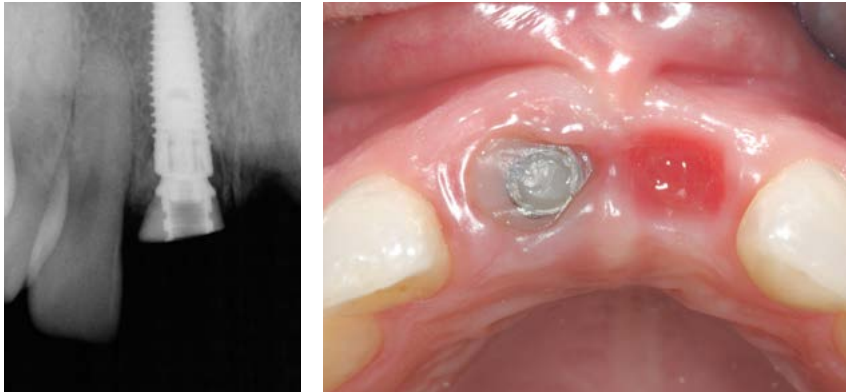


Figure 10: Radiograph of implant/customised abutment and one-week post-op healing

Dual zone grafting involves grafting into both the hard and soft tissue areas to provide a supportive soft tissue scaffold in an attempt to reduce gingival recession (Chu et al, 2017).

No suturing of tissues was required due to support created from graft and customised abutment.

Chlorhexidine was given to use as a mouthwash postoperatively.

Visit four

One-week review showed fantastic healing of the soft tissue. Patient reported very little post-operative discomfort (Figure 10).

Visit five

Three months after implant placement, the patient returned and osseointegration was confirmed with a radiograph and counter torque test.

A screw-retained provisional cantilever bridge (UR1 to UL1) was fabricated using an



Figure 11: Fabricating custom abutment/cantilever bridge to copy custom healing abutment and hence groomed emergence profile of healed soft tissues



Figure 12: Presenting tissue situation and the final tissue development, showing good papilla formation with the lateral incisors and also successful retention of horizontal tissue volume using the dual zone grafting technique

impression taken of the idealised teeth on the patient's denture as a matrix placed over a customised temporary abutment, copied from the healing abutment placed at the time of surgery.

This was removed and attached to an implant replica and was then placed into silicone impression material.

The abutment was removed from the replica then new temporary abutment (full height) was attached (Figure 11).

Bonded flowable composite resin was then used to replicate the emergence profile developed by gingival level provisional abutment.

The impression taken of the denture in situ was now filled with Luxatemp (DMG) and a new cantilever screw-retained bridge was fabricated.

A small amount of pink Permaflo (Ultradent) was bonded to the provisional bridge to mimic the lost central papilla.

An ovate pontic area was developed further with flowable composite in the area of UL1 and customising the emergence from the implant helped to develop the soft tissue shape and position (Wittneben et al, 2013).

The tissues showed fantastic healing with the presence of a few graft inclusions. Some of which were superficial and removed (Figure 12).

Visit six

One month later soft tissues were stable and papilla development with the adjacent lateral incisors was satisfactory.



Figure 13: Fabrication of custom impression coping and silicone impression with centre line and occlusal plane communication to lab using Kois Dentofacial Analyser

A custom impression coping to copy the emergence of the satisfactory provisional was fabricated using a method similar to that detailed above with addition of the ovate pontic site at UL1 (Patras and Martin, 2016).

An impression using an open custom tray was taken in Silicone Express 2 Penta (3M ESPE) (Figure 13).

A sample of pink Permaflo was sent to the lab and a Vita shade of B1 was selected.

A Kois Dentofacial Analyser was used to ensure correct centre line and occlusal plane orientation.

Impressions of the provisional bridge were also taken and sent to the laboratory to allow the idealised form to be copied.

A Nobel Zirconia Angulated Screw Channel, screw-retained cantilever bridge was prescribed with a small central papilla in pink.

Visit seven

The bridge was inserted using an Omnigrip driver (Nobel Biocare) with the screw tightened to a torque of 35Ncm after having irrigated the area with chlorhexidine (Figure14).

PTFE tape was used to block the screw hole, before it was closed with an opaque dentine shade of composite (UD1 HFO [Micerium]) bonded using Adhese Universal (Ivoclar Vivadent).



Figure 14: Delivery of screw-retained cantilever bridge and final result

Full maintenance instructions were given to the patient.

Visit eight

Review confirmed patient satisfaction and oral hygiene was reinforced.

Reflection

The patient, during the consent process, was very clear of her desire for the most minimal surgical approach to implant placement possible, but with an effective treatment outcome.

In some cases, compromises may disincline the clinician from going ahead with treatment as the compromises may be too great. However, in this case, following a comprehensive pre-operative assessment, based on biological parameters, I felt that using an immediate implant placement approach could achieve a good result.

Obviously, we need to offer the best technical product we can, mindful of every technical advantage we can find for our patients to achieve their restorative and aesthetic goals.

Equally it is imperative that the patient is forewarned about potential problems and compromises before any definitive treatment plan is agreed.

In this case, the patient said she would be happy with a result similar in appearance to that of the mock-up on the denture.

My primary aesthetic concern was the loss of central papilla. Pink addition to the bridge was considered acceptable, especially given the low risk of lip line exposing



Figure 15: Final result

the prosthetic-tissue junction in maximum smile, as comprehensively assessed pre-operatively.

The only time we see a problem in the final photos is when lip retractors are placed as this causes frenal pull, however in light finger retraction or no retraction this tissue junction is not seen.

I felt the shade value of the restoration was not perfect, but the patient loved the result, refusing my suggestion of sending it back to the lab for revision.

Patient's testimonial

Since my bridge was fitted the gums look much better and you have given me back my teeth exactly how they were before.

I didn't think that was possible. Thank you so much.

I was devastated when I was assaulted and never thought I would smile again but you have given me something to smile about.

References

- Buser D, Martin W and Belser UC (2004) Optimizing Esthetics for Implant Restorations in the Anterior Maxilla: Anatomic and Surgical Considerations. *Int J Oral Maxillofac Implants* 19(SUPPL): 43-61
- Buser D, Chappuis V, Belser UC and Chen S (2017) Implant placement post extraction in esthetic single tooth sites: when immediate, when early, when late? *Periodontology* 73: 84-102
- Chu S, Salama M, Salama H, Garber D, Saito H, Sarnachiaro G and Tarnow D (2012) The dual-zone therapeutic concept of managing immediate implant placement and provisional restoration in anterior extraction sockets. *Compend Contin Educ Dent* 33(7): 524-32, 534
- Garber DA and Belser U (1995) Restoration-driven implant placement with restoration-generated site development. *Compend Contin Educ Dent* 16(8): 798-802
- Guerrero ME, Noriega J and Jacobs R (2014) Preoperative implant planning considering alveolar bone grafting needs and complication prediction using panoramic versus CBCT images. *Imaging Science in Dentistry* 44(3): 213-20
- Patras M and Martin W (2016) Simplified custom impression post for implant-supported restorations. *The Journal of Prosthetic Dentistry* 115(5): 556
- Salama M, Ishikawa T, Salama H, Funato A and Garber D (2008). Advantages of the Root Submergence technique for Pontic Site Development in esthetic implant therapy. *Int J Periodontics Restorative Dent* 27 (6): 521-7
- Wittneben J, Buser D, Belser U and Bragger U (2013) Peri-implant soft tissue conditioning with provisional restorations in the esthetic zone: the dynamic compression technique. *Int J Periodontics Restorative Dent* 33(4): 447-55.