PATIENT NT
GENDER: MALE
AGE: 28

PRESENTING COMPLAINT

Missing anterior teeth, patient wanted to explore fixed options

HISTORY OF PRESENTING COMPLAINT

- Fell off BMX bike 2.5 years ago, fracturing UR1 and UL1 and laterally luxating UR2 (previously palatally instanding – trauma appears to have exacerbated this).
- UR1 and UL1 extracted, UR2 remained in luxated position.
- Upper removable acrylic partial denture constructed. Secure when speaking but can displace during mastication.
- Patient would also like to improve aesthetics of tooth replacement – not concerned regarding UL4 space, main concern is incisor region.

DENTAL HISTORY

Life-time treatment	Numerous extractions when younger through dental neglect
Recent Treatment	Extraction of maxillary central incisors and construction of upper partial denture 2.5 years ago. Only one denture constructed.
Patient expectations	Medium, the appearance of the teeth are of secondary concern to the fixed nature of the prosthesis
Dental phobia	None
Oral hygiene regime	Brushes twice daily with fluoride toothpaste and manual toothbrush. No interdental cleaning or mouthwash
Diet	Previously drank a 500ml bottle of fizzy drink a day over prolonged period, now water. Average sugar intake from simple questioning

SOCIAL HISTORY

- Unemployed – patient felt that appearance of front teeth is restricting his job opportunities
- Lives with partner and 3 year old son
- No alcohol consumption
- Smoker – 5 conventional cigarettes a day for 5 years

MEDICAL HISTORY

No known conditions
No medications
No allergies

EXTRA-ORAL EXAMINATION

Facial Asymmetry	None
Lymphadenopathy	None
Tempromandibular joint	No abnormalities detected
Mouth Opening	Normal range
Muscles of mastication	No abnormalities detected
Lip line at rest	Medium
Smile line	Medium
Smile Symmetry	Symmetrical
Skeletal relationship	Class I

INTRA-ORAL EXAMINATION

Soft tissues	No abnormalities detected
Gingival tissues	Pink with racial pigmentation
Gingival phenotype	Moderate
Pocketing	None
Recession	None
Erosion	very minimal cupping lesions
Caries	Cavitated, minimal enamel caries UL2 mesially. Non-cavitated, arrested caries UL5 mesially

BPE

1	1	1
2	2	1

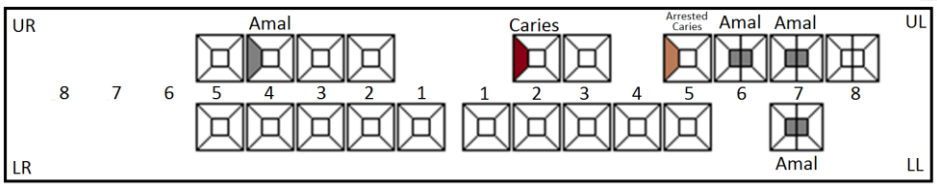
OCCLUSION

Incisal Relationship	UL2 - Class I, UR2 – Class III
Centre lines	No upper central incisors present, however when using the denture teeth the upper centreline is deviated to the right and non-coincident with lower incisors.
Crossbite	UL2
Crowding	Intertooth width between UR3 and UL2 - 18mm
Anterior openbite	None
Wear Facets	Distal corner UR2
Fremitus	None
Centric relation:Centric occlusion	Coincident

GUIDANCE

Incisal guidance	Protrusion = UR2-LR2
Lateral excursions	Left - UL3 – LL2 Right - Group function
Working side interferences	None
Non-working side interferences	UR2 with mandibular movements to the left

Dental Chart



PROSTHESIS

- Upper removable acrylic partial denture to replace UR1, UL1 and UL4.
- No clasps, poorly adapted to hard and soft tissues, fractured/missing portion from mid UL4 backwards.
- Gap between central incisor teeth and soft tissues, shade discrepancy and suboptimal sizing of teeth

PRE-OPERATIVE PHOTOGRAPHS

Figure 1.1 Extra-oral with denture

Figure 1.2 Intra-oral with denture

Figure 1.3 Right lateral view with denture

Figure 1.4 Left lateral view with denture

Figure 1.5 Upper occlusal view with denture

Figure 1.6 Lower occlusal view

Figure 1.7 Intra-oral view

Figure 1.8 Right lateral view

Figure 1.10 Upper occlusal view

SPECIAL INVESTIGATIONS

	UR3	UR2	UL2	UL3	UL5
TTP	-	-	-	-	-
Mobility	0	0	0	0	0
Discolouration	-	-	-	-	-
Labial/Buccal Tenderness	-	-	-	-	-

Electric Pulp Tester	+	+	+	+	+
Ethyl Chloride	+	+	+	+	+

RADIOGRAPHS

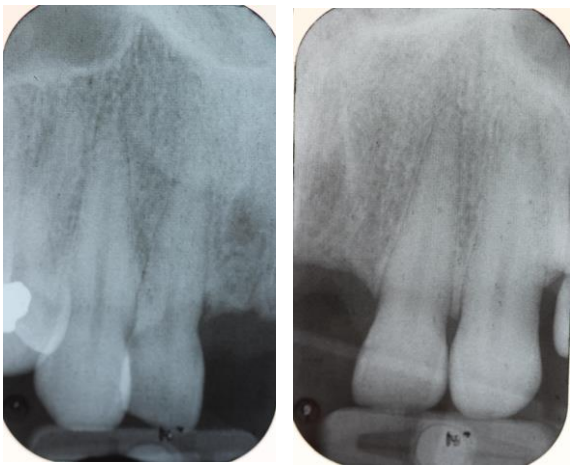


Figure 2.1 (Left) and 2.2 (Right) Intra-oral periapical radiographs of UR3,2 and UL2,3

Quality of radiographs – 1

Report

Caries	Enamel lesion, mesial aspect UL2
Bone levels	Mild reduction in bone height in edentulous areas, likely associated with remodelling following tooth extraction
Apical tissues	No abnormalities detected
Other	Prominent incisive canal. Root canal systems visualised on all imaged teeth, good root length and crown size UL2

DIAGNOSES

Trauma related loss of UR1 and UL1 and lateral luxation UR2
Caries UL2 mesially
Acquired tooth loss
Mild tooth surface loss – cupping lesions

PROGNOSIS

UR2 laterally luxated – Dental Trauma guide states **REF** 75% of teeth which have been laterally luxated devitalise at 5 years

Dental Implant Assessment

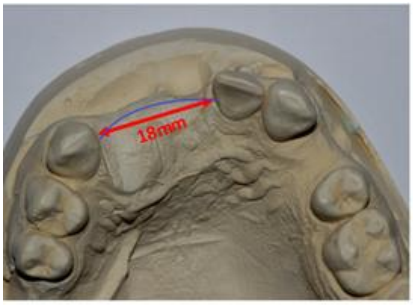


Figure 3.1 Occlusal view showing UR2 removed from model, inter tooth width between UL2 and UR3 (red line) and a line to show approximate labiopalatal positioning of potential implant placement (Purple)

Figure 3.2 (left) & figure 3.3 (right) Height of alveolar bone available for implant placement UR2 and UL1 regions

	UL1 – 20mm
Inter-Occlusal Space	6mm
Buccal-Lingual Concavity	Moderate-Severe
Attached Gingiva	Present
Incisive Canal	Prominent – Within implant site
ITI SAC Surgical Classification	Complex

Patient's Treatment Goals

The patient would like a fixed, aesthetic restoration of the central incisors

TREATMENT PLANNING OPTIONS FOR REPLACEMENT OF MAXILLARY INCISOR TEETH

1. No treatment – accept current appearance/restoration
2. Diagnostic wax up - Extract/Maintain UR2
    a. Removable partial denture
        i. Acrylic
        ii. Cobalt-chrome
    b. Resin Retained Bridge
        i. 3**21**|**1**2
        ii. 3**21**|2
        iii. 3**21**|2 + composite mesial aspect UL2 to increase width
    c. Fixed-Fixed conventional bridge 3**21**|**1**2
    d. Dental Implants 2|1 with prosthesis 2**1**|1
    e. Orthodontic redistribution of space and tooth replacement options detailed above

EVIDENCE SUPPORTING TOOTH REPLACEMENT OPTIONS

Removable Partial Dentures

Removable partial dentures (RPD) offer a cost effective solution to restore teeth and the associated hard and soft tissues, that in most cases can easily be repaired if required. A ten-year evaluation of RPDs showed a 75% survival rate at 5 years and 50% at 10 years (Vermeulen et al 1996). Bergman et al (1995) concluded after a 25 year follow up of RPDs that they are a valuable treatment option for patients missing numerous teeth, finding no increase in gingival inflammation or mobility of abutment teeth in RPD wearers.

However there are some issues associated with RPD use that should be considered when treatment planning. The evidence points to a higher caries incidence associated with RPD wearers when compared to fixed alternatives (Jepson et al 2001) which Budtz-Jørgensen and Isidor (1990) showed can be up to 6 times more likely when compared to conventional bridges. As NT has previously lost teeth through dental neglect this should be considered carefully.

There is also evidence to suggest patients who wear an RPD are more susceptible to root caries (Wright et al 1992) which is a concern even for patients who don't exhibit gingival recession, as the same group also showed a relationship between RPD wearing and increased gingival recession (Wright and Hellyer 1995).

Another factor that should be considered when treatment planning is the resorption of the residual ridge due to occlusal forces especially if dental implants are to be considered in the future (Klemetti et al1996).

The UR2 could be maintained with this option, offering a relatively low risk solution that would allow removal of the denture and returning the patient to how they were at the start of treatment. Dentures would offer full lip support, allowing the restoration of the hard and soft tissue in the upper anterior sextant lost due to alveolar ridge resorption. Partial dentures would also give an opportunity to replace teeth in the UR posterior sextant.

The patient had expressed a desire for fixed tooth replacement due to the difficulties they have previously experienced. However a cobalt chrome denture utilising tooth support and clasping has not been explored and this option may offer a secure, minimal palatal coverage option to replace all missing teeth.

Either a well fitting acrylic or a well fitting cobalt chrome denture is likely to be a large improvement on the poorly fitting, fractured acrylic denture that is currently being used. However an important factor in the decision making process was whether the patient was happy to accept the edentulous space in the UR sextant, if they weren't, this would limit the options available.

The patient did not wish to replace the teeth in the UR sextant, which meant he could explore fixed options to replace the upper incisor spaces and UL4 space.

Resin Retained Bridge

Resin retained bridges (RRB) offer a relatively low cost solution to replace missing teeth and in certain circumstances associated soft tissue, with no or very little tooth preparation required. In most circumstances, failure of an RRB will result in debond, where the underlying tooth tissue remains undamaged. The survival rates vary in the literature, however it has been shown that maxillary restorations can have a 65% survival rate at 5 years, ranging up to 98.9%, with a mean survival of 7 years 10 months (Creugers et al 1992, Djemal et al 1999, De Kanter et al 1998, Pjetursson et al 2008). Recently King et al (2015) reported survival rates of 80.4% at 10 years.

RRBs may not be as successful in patients where the abutment teeth are heavily restored, however smaller restorations should be changed for newly placed composite, to improve bonding. They may also have reduced survival times in patients who are bruxists. Where a small clinical crown is present, thought should be given to alternative tooth replacement options (Ibbetson 2004). The three most common complications associated with RRBs are debonding, tooth discoloration, and caries (Goodacre et al 2003) However this can be addressed by using full palatal coverage with incisal edge overlap for upper anterior teeth with an opaque cement to block out metal shine through.

The position of UR2 may result in a plaque trap and reduced surface area of the wing abutment that could be used for UR3. The tooth would also be visible behind any tooth replacement, therefore in order to provide a cleansable restoration extraction of this tooth would be required for fixed options.

The UL2 had a good root length and the crown was of a good size to facilitate the bonding of a RRB. A RRB could also have pink porcelain added to offer lip support for missing tissues. Whilst the UL4 space could also be filled using resin bridgework, the restoration of the UR posterior sextant would be limited to a premolar sized pontic utilising a distal cantilever approach, which although potentially unopposed has a less favourable prognosis than mesial cantilevered bridges (Schweitzer 1968).

This option would fulfil the patient's desire to have a fixed tooth replacement option in the upper anterior sextant.

Conventional bridgework

Pjetursson et al (2007) carried out a meta-analysis of the 5 year survival of tooth-supported conventional fixed bridgework (TSCFB) versus implant-supported fixed bridgework (ISFB) versus single crowns. He described a 5-year survival of TSCFB of 93.8%, cantilever conventional bridgework of 91.4% and ISFB of 95.2%. However survival is not the same as success, which was also demonstrated in the study, which showed 38.7% of patients with ISFB experienced some complications after the 5-year observation period compared with 15.7% TSCFB and 20.6% for cantilever conventional bridgework. They described caries and loss of pulp vitality as the most frequent complications, with 6.1% of abutment teeth exhibiting loss of vitality. This is reinforced by the earlier study by Goodacre et al (2003) which reported the 3 most commonly reported complications with TSCFB were caries in 18% of abutments, loss of vitality in 11% of abutments, and loss of retention in 7% of prostheses.

The survival rates described in various studies are relatively comparable The mean survival time of conventional bridgework has been reported as 10.5 years, with a 12% failure rate at 10 years (Valderhaug 1991). With Tan et al (2004) finding a probability of survival at 10 years of 89.1% and Creugers et al (1994) finding a 74.0% survival rate +/- 2.1% after 15 years.

It is clear that in the right clinical environment and in the right hands fixed conventional bridgework is a good treatment option to provide restoration of certain edentulous spaces. However it is also clear from the literature that service, maintenance and replacement are common requirements, which should be considered when treatment planning this type of bridgework, especially for the younger patients, who will potentially require many more years of service than the literature currently reports. They will also have larger pulps which may result in complications e.g. loss of vitality (Goodacre 2003).

Although conventional bridgework would offer fixed tooth replacement, the UR3 is unrestored and the UL2 has a small mesial restoration. Therefore a substantial amount of sound tooth tissue would have to be removed in order to facilitate placement of conventional abutments. This is likely to be between 63% and 72% of the coronal tooth structure (Edelhoff and Sorensen 2002), thus weakening the underlying tooth structure unnecessarily and also potentially cause devitalisation of the abutment teeth.

NT is 28 years old and it is reasonable to assume, based on the current literature that the bridge will at least require replacement during a patient's lifetime if not suffer a failure. In addition to this, should the bridge fail, it is more likely to be catastrophic for the abutment teeth when compared to a RRB, which is likely to just debond from the abutment tooth (Goodacre 2003). Given this, conventional bridgework was considered not to be a preferred treatment option.

Dental Implants

A removable implant retained prosthesis would not be a first line choice in this scenario given the pattern of tooth loss a removable prosthesis could be retained utilising the remaining teeth. However a fixed implant supported prosthesis would certainly address the patients request for a fixed restoration which would restore function. Survival data relating to dental implants is more complicated than other tooth replacement option. There are many different variables, in the form of systems, designs, surgical techniques and prosthetic options and so consequently the research has been spread thinly, trying to look at all these aspects, with comparatively little depth in each sub-category when considering the literature of other tooth replacement options. The implants that were available 15 years ago, in most cases aren't the same design today and therefore one has to question the full applicability when using these figures for current treatment planning.

As mentioned previously the meta-analysis by Pjetursson et al (2007) described a 95.2% 5 year survival rate of implant supported fixed bridgework however this is dependent on a multitude of factors. It is thought that choosing a cement-retained prosthesis versus a screw-retained prosthesis does not impact on the implant survival rate when careful techniques are applied (Sherif et al 2014). However smoking has been shown to increase the likelihood of osseointegrated implant failure, in particular those situated in the maxilla (Hinode et al 2006) which is particularlypertinent to this patient who not only smokes 5 cigarettes a day but also requires maxillary restorations.

These failures are likely to be associated with peri-implantitis, especially in a patient that smokes, which some studies have suggested increases the frequency by 36.3% (Hinode et al 2006), however this may decrease with supportive periodontal therapy. The frequency of peri-implant mucositis observation is in 63.4% of patients, with 18.8% of the total population with implants exhibiting peri-implantitis at some stage (Atieh et al 2013)

Another consideration when planning potential implant placement is in order to conform to the natural curvature of the maxillary arch, bone augmentation would be required to facilitate implant placement in the correct position to avoid a large, non-cleansable labial overhang of the prosthetic teeth to facilitate placement of the upper incisors in the correct position. This would also offer lip support, replacing the missing hard/soft tissue in the region however this is more involved with a higher complexity level compared to the other tooth replacement options.

The local anatomy should also be carefully considered, in the anterior maxilla the size and position of the nasopalatine foramen is important. It can be visualised on the IOPA radiographs shown in figure 2.1 and 2.2. It appears adjacent to the UL2 and although a cone beam computer tomography scan would be required for full assessment, it is likely that there would not be enough space for dental implant placement between the UL2 and nasopalatine foramen unless the UL2 was extracted to facilitate implant placement, in which case the stakes would be significantly higher to ensure a successful restoration but this may offer slightly more control to evenly distribute space with alteration of the incisor widths between the canine teeth.

An alternative solution would be extraction of UR2 and placement of a cantilever implant supported bridge, depending on the patient's preferred tooth set-up.

Given the cost involved in placement and maintenance of dental implants and the patient decided against this option

Orthodontic treatment

Orthodontic tooth movement would allow redistribution of spaces and teeth to facilitate ideal tooth set-ups for replacement options +/- ideal position of dental implants. The orthodontists would need to consider the lack of teeth available for anchorage in the UR sextant, however, given the centreline has shifted to the right, orthodontic treatment would likely look to distalise the UL3 and 2, in which case there would be sufficient anchorage in the form of the molar teeth in the UL sextant. The patient ruled out orthodontic treatment therefore this was not explored.

PREFERRED TREATMENT OPTION FOR PATIENT

The patient chose option 2b therefore the following treatment steps were followed:

1. Oral hygiene instruction and full mouth scale
2. Diet advice
3. Restoration UL2
4. Diagnostic wax ups and intra-oral try in – varying pontic size, number and positioning
5. Extraction UR2
6. Provision of immediate upper acrylic partial denture to patient's preferred diagnostic wax up tooth set up
7. Period of healing 2/12 – given instanding position of UR2, boney remodelling is unlikely to affect pontic site
8. Resin Retained Bridges 3**21**|**1**2 and |**4**5

Figure 5.1 Thin suckdown matrix based on diagnostic wax, with tooth coloured acrylic facings over teeth to be replaced.

Given the challenges of reduced space and centreline shift, diagnostic wax ups for ideal tooth set up were used to ensure the patient could fully consent to the extraction of UR2 and to placement of a restoration to restore the anterior edentulous space. Figure 5.2 to 5.7 show the diagnostic wax ups and the vacuum formed trail set ups used. Figure 5.1 shows the design of the suck down trials, which were used to quickly switch between set ups and allow the patient to take them away if they needed time to reflect on their chosen tooth set up.

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Upon try in, it was clear that the patient did not like the asymmetry associated with only two pontic teeth and preferred the set up shown in figure 5.2 and 5.3. Therefore the immediate removable partial denture was constructed to this tooth set up, which also offered an extra opportunity for the patient to get used to the tooth set up. This was converted to fixed-fixed resin retained bridge following a period of healing, shown in Figures 6 and 7.

RESIN RETAINED BRIDGES PRIOR TO CEMENTATION

Figure 6.1 RRB 3**21** | **1**2 labial view

Figure 6.2 RRB 3**21** | **1**2 & |**45** Occlusal view

Figure 6.3 RRBs on model

Figure 6.4 RRBs on model

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POST OPERATIVE PHOTOGRAPHS AND THE RESIN RETAINED BRIDGES IN-SITU

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