

Schottlander **enigmalive** artificial teeth prosthodontic audit



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Introduction

Replacing missing teeth is still and will continue to be a much-needed service in the future. In the latest (2009) Adult Dental Health Survey approximately 20% of people have less than 21 teeth left, and in England alone, 6% of people are edentulous. These figures are higher in Wales and Northern Ireland. There are good clinical reasons why a continuing, although perhaps low, incidence of total tooth loss may be expected to occur over the next 30 years. Some forms of dental disease although rare, are destructive and very difficult to treat. This specifically applies to generalised periodontitis stage 4 grade C. Possibly of greater impact though, are the effects of more common causes of tooth loss such as trauma, caries and periodontitis of slower progression being cumulative over a lifetime. With life expectancy increasing there will probably always be some people for whom the life of their dentition is shorter than their lifespan.

A high level of patient satisfaction, in removable prosthodontics should be the primary goal in the treatment of patients with missing teeth. The function and appearance of the artificial teeth are crucial factors in achieving this. Following six years development, Schottlander introduced **enigmalive**

teeth to the market in 2014 (figure 1). These were developed with direct input from dental specialists, dentists, clinical dental technicians and technicians with the principal objectives of natural aesthetics and longevity. The **enigmalive** teeth superseded the Schottlander engima teeth brought to market in 1999. In 2004 Schottlander received a Queen's Award for Innovation for engima and natura teeth, the only dental company to receive such an award.

Our experience of using Schottlander **enigmalive** teeth

Schottlander **enigmalive** teeth have been used in my Specialist Referral Private Practice for all conventional and implant supported removable prosthodontic cases since 2014. In addition, they have been used for all hybrid fixed implant supported restorations fitted in the practice. Figures 2 to 6 show examples of the different type of restoration we fabricate for our patients using Schottlander **enigmalive** teeth.

We have audited all of our cases using **enigmalive** teeth. This is presented in table 1.

Table 1. Audit of **enigmalive** teeth used in the practice over a 6 years period.

Type of prosthesis	Number of prostheses	Total number of enigmalive teeth	enigmalive teeth breaking	(%) Survival of enigmalive teeth
Removable complete dentures	179 (46%)	2158 (55%)	2	99.9%
Removable partial dentures	167 (43%)	1296 (33%)	0	100.00%
Implant supported removable prostheses	27 (7%)	315 (8%)	3	99.0%
Milled bar implant supported removable sleeve prostheses	4 (1%)	48 (1%)	2	95.8%
Acrylic wrapped Fixed dental prostheses	8 (2%)	96 (2%)	1	99.0%
All prostheses	385 (100%)	3913 (100%)	8	99.8%

The failure rate of **enigmalive** teeth in our practice has been 0.2% over the 6-year audit. Considering the prevalence of bruxism (30%) in the general population and the wear that these teeth are subject to, this is a testament to the excellent durability of these artificial teeth.



Figure 1: **enigmalive** teeth.



Figure 4: Removable implant supported denture.



Figure 2: Complete denture.



Figure 5: Milled bar implant supported removable sleeve prosthesis in maxilla.



Figure 3: Removable partial denture.



Figure 6: Fixed implant supported acrylic wrapped metal beam.

Audit of the differences between conventional dentures and implant supported dentures.

Type of prosthesis	Number of prostheses	Total number of enigmalive teeth	enigmalive teeth breaking	(%) Survival of enigmalive teeth
Conventional denture	346 (90%)	3454 (88%)	2	99.9%
Implant supported denture	39 (10%)	507 (13%)	6	98.8%

Analysis of failure of enigmalfite teeth used in our practice over 6 years

- Tooth type – six maxillary lateral incisors, one maxillary central incisor and one lower lateral incisor (figure 7).
- Five male patients (One fixed hybrid prosthesis two complete implant supported dentures and two complete dentures) and three female patients (one milled bar implant supported removable sleeve prostheses and two complete implant supported dentures)
- All patients exhibited bruxism.
- Four out of the eight fractures were opposing natural dentition.
- The mean length of time in service before fracture was eighteen months.



Figure 7: Example of a fractured upper left lateral central incisor on a bar sleeve implant supported removable prosthesis.

I believe that fracturing of the teeth would have occurred with all makes of prosthetic teeth in these types of patient. A large majority (95%) of our patients are received via referrals from their general dental practitioners and require specialist prosthodontics. As such, we generally treat patients who are technically challenging and often exhibit parafunction in the form of bruxism. Bruxism is the dental term for teeth grinding and jaw clenching. It is often related to stress or anxiety. The forces generated during bruxism are huge and cause natural teeth to wear and break too. Any artificial material which replaces tooth substance such as fillings, crowns, bridges and dentures are subject to these forces when in the mouth and as a result will wear and fracture at some stage. Bruxism continues throughout life being exacerbated by stress such as major life events. It is not possible to stop it. In order to minimise the potential for fracturing of the prosthetic teeth all of our cases are mounted with a facebow transfer in centric relation on a Denar Mk II semi-adjustable articulator (Whip Mix, USA). The prosthetic teeth are set up so that the anterior guidance is placed on the canines, premolars and molars. These are the most suitable prosthetic teeth to withstand these forces. Occasionally aesthetics dictate that the overbite results in the protrusive guidance being placed on the incisors. In these situations we give the patient slightly more over jet if aesthetics allow. If this is not aesthetically suitable for the patient and the guidance has to be placed on the incisors, we

warn them that the anterior teeth may be more prone to fracture. For our patients with fixed prosthetic replacements an occlusal soft splint to be worn at night (when the heaviest bruxism occurs) is recommended (figure 8). Compliance with wearing a night-time splint is known to be poor even when the benefits are clearly explained to the patient. This will be a contributing factor for the increased fracture rate of denture teeth in patients with implant supported prostheses. If the patient has a removable denture and wishes to wear them at night we recommend an additional set of dentures for this purpose. This means that they have a spare set.



Figure 8: Occlusal soft splint fitted over fixed maxillary hybrid denture to be worn during sleep to protect the prosthetic teeth.

I ceased using enigma teeth in January 2014 when **engimalife** teeth became available. The reasons for changing to **engimalife** teeth were:

1. Improved aesthetics
2. improved in-vitro data regarding wear resistance

Audit of enigma teeth used in our practice over 12 years.

Type of prosthesis	Number of prostheses	Total number of enigma teeth	enigma teeth breaking
Removable complete dentures	104	1248	1
Removable partial dentures	65	439	0
Implant supported removable prostheses	27	392	8
Acrylic wrapped Fixed dental prostheses	26	260	3
All prostheses	222	2339	12

The failure rate of enigma teeth in our practice has been 0.5% over the 12 - year audit. They show excellent levels of durability over this period. Like the **engimalife** data most of the tooth breakages (92%) occurred in implant supported prostheses which are subject to significantly greater loads than none implant supported removable dentures. Dental implant supported teeth are subject to high forces owing to reduced proprioception and feedback and as a result mechanical failure in these types of restorations is high.

CONCLUSION

Schottlander **engimalife** teeth have been used in a specialist private practice for all of the conventional and implant supported removable prosthodontic cases since 2014. In addition, they have been used for all of hybrid fixed implant supported restorations fitted in the practice. They have been found to be excellent both functionally and aesthetically and I recommend them highly from both a technical aspect and a patient satisfaction aspect.

Finlay's practice is based in Garstang in the North West of England limiting his practice to removable prosthodontics. Working with his highly skilled dental technician, Rowan Garstang, in the room next door, they provide superbly functioning and life-like dentures for patients. Finlay qualified in 1993 and spent six years in general practice, finding prosthodontics difficult. He left general practice and gained seven years formal prosthodontics training at Manchester and Liverpool dental hospitals, prior to establishing a referral practice in 2007. Finlay's 3 areas of denture-work; 1. clinical provision for patients, 2. training/lecturing/mentorship for dental professionals, 3. research and development.

For further information on **engimalife** please contact **Schottlander** on:

Freephone 0800 97 000 79, sales@schottlander.co.uk or visit **www.schottlander.com**

At **www.engimalife.co.uk** you will find a dedicated website with separate sections for dental professionals and patients. It not only shows before and after cases but also provides help and advice for patients.

Case 1 - The provision of an immediate maxillary acrylic based complete denture and mandibular acrylic based partial denture

This 45 year old woman was referred to me by her general dentist for prosthodontic treatment in 2017. She was ready to have treatment in 2019 when the upper right central incisor and the lower right central incisor exfoliated owing to further progression of the periodontitis.

Dental Concerns

“Currently I am experiencing pain in my gums and teeth. Some of my teeth are loose, crooked and I have gaps. I also have lots of discolouration.”

The upper right central incisor (UR1) and lower right central incisor (LR1) had exfoliated by the time of the second consultation in 2019.

Social History

Past cigarette smoker. 20 per day for 30 continuous years. Stopped 2018.

Dental wish

1. “For the pain to stop”
2. “Able to smile without feeling conscious”
3. “No gaps in my teeth”
4. “No discolouration”

Dental diagnoses 2019

1. Generalised periodontitis; stage IV grade C: currently unstable, risk factors: recent ex smoker.
2. The remaining maxillary teeth had hopeless prognosis in the short to medium term. They exhibited 80 - 100% alveolar bone loss with increased mobility (Grade 2 - 3).

3. The mandibular incisors (LR2, LR1, LL1 and LL2) had hopeless prognosis in the short term. They exhibited 80 - 100% alveolar bone loss with grade 3 mobility.
4. The remaining mandibular teeth (apart from LR7) had approximately 50 - 70% alveolar bone loss with grade 1 mobility.
5. Maxillary and mandibular acrylic based partial dentures replacing missing UR1 and LR1 exhibiting, poor fit and aesthetics. These had been fitted by the referring general dental dentist between the first consultation in 2017 and 2019.

Phase One -

Treatment options discussed with the patient:

1. Do nothing.
2. Immediate complete upper denture and mandibular acrylic based partial denture fitted at the extraction of the hopeless teeth and management of the periodontal condition.

Following consultation (2017) and a second discussion appointment (2019 - 2 years later following exfoliation of the UR1) the patient chose to have option 2 involving, immediate complete upper denture and mandibular acrylic based partial denture to be fitted at the extraction of the hopeless teeth alongside management of the periodontitis of the remaining natural teeth.

The process of treatment provision is summarised in the figures (9 to 24) and captions.



Figure 9:
Pre-treatment with generalised periodontitis; stage IV grade C, unstable, risk factors: recent ex smoker. Prior to phase one treatment of immediate complete upper denture and immediate mandibular acrylic based partial denture.



Figure 10:
Pre-treatment with generalised periodontitis; stage IV grade C, unstable, risk factors: recent ex smoker. Prior to phase one treatment of immediate complete upper denture and immediate mandibular acrylic based partial denture. 2019 - exfoliated UR1



Figure 11:
Pre-treatment radiograph from 2016 - 80 - 90% bone loss in maxillary teeth, 50 - 90% bone loss in mandibular teeth.



Figure 12:
Visit 1 impression making. Futar D (Kattenbach- dental, Germany) used to block out the undercuts of the grade 3 mobile teeth - avoiding accidental extraction of the teeth in the impression.

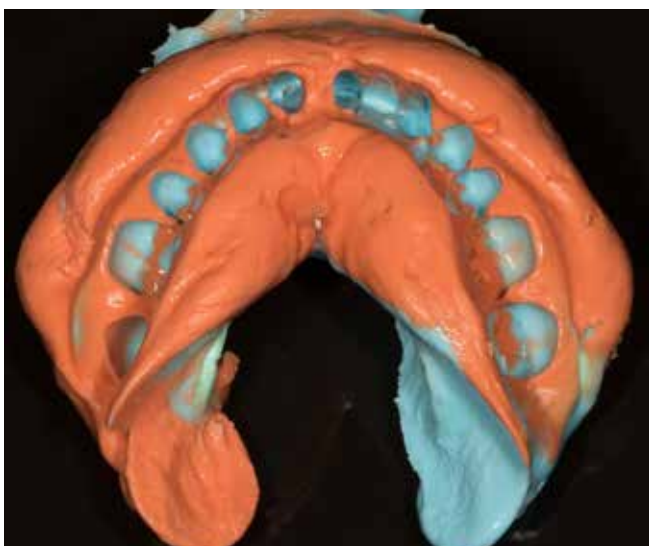


Figure 13:
Visit 1. Mandibular primary impression made in two stages using Accudent XD, (Ivoclar Vivadent, Lichtenstein). This allows full extension to record the sulcus. This was used to produce a primary cast on which the immediate partial denture was constructed. The teeth were too mobile to risk accidental extractions for definitive impressions.



Figure 14:
 Visit 1. Maxillary primary impression made in two stages using Accudent XD, Ivoclar (Ivoclar Vivadent, Lichtenstein). This allows full extension to record the sulcus. This was used to produce a primary cast on which the immediate complete denture was constructed. The teeth were too mobile to risk accidental extractions for definitive impressions.



Figure 15:
 Primary mandibular cast used for fabrication of the immediate mandibular acrylic based partial denture.



Figure 16:
 Primary maxillary cast used for fabrication of the immediate maxillary complete denture. Post dam indicated prior to carving to produce posterior palatal seal.



Figure 17:
 A photograph of the pre-operative position of the teeth, a photograph of the natural teeth prior to drifting and a photograph of the immediate dentures mimicking the natural tooth positions, sizes and arrangement. The patient had missing maxillary lateral incisors with canines in the lateral incisor position. The patient wanted this replicating in the denture.



Figure 18:

Prepared primary maxillary cast. Minimal preparation of the cast apart from careful removal of the teeth owing to gross periodontal attachment destruction and alveolar bone loss. Cupids bow post dam to produce posterior palatal seal.



Figure 19:

Maxillary complete immediate denture mimicking the natural tooth positions, sizes and arrangement using **enigmalive** teeth (Schottlander, UK). The patient had missing maxillary lateral incisors with canines in the lateral incisor position. The patient wanted this replicating in the denture.



Figure 20:

Maxillary complete immediate denture mimicking the natural tooth positions, sizes and arrangement using **enigmalive** teeth (Schottlander, UK). The patient had missing maxillary lateral incisors with canines in the lateral incisor position. The patient wanted this replicating in the denture.



Figure 21:

Mandibular immediate acrylic based partial denture using **enigmalive** teeth (Schottlander, UK).



Figure 22:
Visit 2 - Removal of remaining maxillary natural teeth and LR7, LR2, LR1, LL1, LL2.



Figure 23:
Visit 4 - Maxillary complete immediate denture and mandibular immediate acrylic based partial denture fitted using **enigmallife** teeth (Schottlander, UK). The patient had missing maxillary lateral incisors with canines in the lateral incisor position. The patient wanted this replicating in the denture. Cross bite on the right - photograph in ICP



Figure 24:
Visit 3 review post extraction. Maxillary complete immediate denture and mandibular immediate acrylic based partial denture fitted using **enigmallife** teeth (Schottlander, UK). The patient had missing maxillary lateral incisors with canines in the lateral incisor position. The patient wanted this replicating in the denture.

Case 2 - Bar and sleeve over denture prosthodontic rehabilitation

This 77 year old lady was referred to me after having extensive prosthodontic treatment involving dental implants. The treatment was incomplete and failing with the temporary bridge having “fallen out” a number of occasions.

Dental Wish

“My main wish is to be able to be confident about my teeth”.

Initial findings

1. 3 dental implant systems in situ in the upper jaw, supporting a temporary bridge, namely:
 - (i) Nobel Biocare Replace Select implants - UR6 and UR5 with associated bone loss
 - (ii) Ankylos implants - UR3, UL1, LR4
 - (iii) TBR implants - UL3, UL4 and UL6
2. A metal ceramic dental bridge replacing LL6 to LR3
3. Loose implant supported bridge LR45

Diagnostic phase of the treatment for the maxillary arch:

The upper temporary bridge was removed to directly assess the implants. The UR5 implant had complete loss of integration. The UR4 was still integrated with 50% marginal bone loss. The rest of the implants in the maxilla were well integrated. The angulation and position of the upper implants precluded the use of a fixed hybrid restoration, as this would have been impossible to clean owing to the depth of flange being required to offer appropriate lip support and aesthetics. In addition, the implant positions and angulation precluded the use of angle correcting attachments (such as Locator attachments) to retain the complete upper over denture for functional and aesthetic reasons.

Following the diagnostic phase, three definitive options for the maxillary arch were discussed, including the advantages and disadvantages of each option:

Option 1:

Complete upper denture fitting over healing abutments. The patient did not want this option because she didn't want to have palatal coverage.

Option 2:

Restoration with a with a bar supported sleeve over denture using the existing implants. This is the option the patient requested as this restoration would be as close to a fixed restoration as possible without having further implant placement surgery. The patient

understood that further implant failure would potentially result in the bar and sleeve restoration becoming redundant meaning that a complete upper denture fitting over healing abutments (option 1) or more extensive treatment would be necessary (option 3).

Option 3:

Removal of most or all of the upper implants, bone grafting and restoration with a fixed hybrid implant supported bridge. The patient did not want this option as this was too extensive and invasive. In addition, the patient did not want further implant placement as implants had failed in the past and she did not want to risk the potential for further implant failure in the future.

Definitive treatment phase:

Maxillary Arch: Bar supported sleeve over denture. Two sleeve dentures were constructed to be worn on alternate days in order that the bar/sleeve/Locator attachments and teeth wear at similar rates. This means that when one of the sleeve dentures has a tooth breakage or fracture, it can be refurbished straight away. The other sleeve denture can be worn during this period and is totally comfortable and the patient is fully adapted to it.

Mandibular Arch: Replacement of the metal ceramic tooth supported bridge with a zirconia ceramic bridge

Post definitive treatment maintenance (initially to be provided on a 6 monthly basis with a view to extending to annually in the future if the patient wishes):

- Examination of the soft tissues of the mouth.
- Examination of the health of the lower teeth and bridge.
- Examination of the dental implants and bar, by removing and rechecking the bar.
- Checking of the structural integrity of the restorations/bar etc.
- Checking of the wear on the 2 sleeve dentures and cleaning them in the Sympro denture cleaner.
- Assessing the bar and teeth cleaning techniques and providing coaching as necessary.

The process of treatment provision is summarised in the figures (25 to 44) and captions.



Figure 25:
Pre treatment -
with temporary
maxillary
implant supported
bridge in situ.



Figure 26:
Old photograph of the
patient with her natural
dentition. She wished
to have this tooth
arrangement mimicked
in the new prosthesis.



Figure 27:
Pre treatment - with temporary maxillary implant
supported bridge in maximum intercuspation.



Figure 28:
Pre treatment - with temporary maxillary implant
supported bridge and mandibular metal ceramic bridge
with teeth apart.



Figure 29:
Pre treatment - panoramic radiograph showing no
bone attachment around the UR6 implant and 50%
bone loss on the UR5 implant.

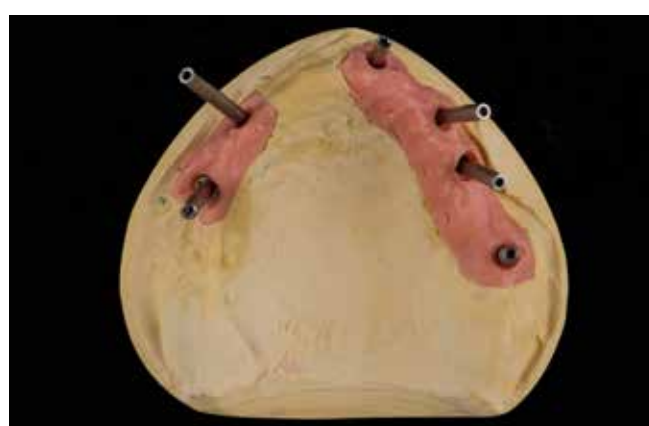


Figure 30:
Diagnostic maxillary cast of fixture angulations with
impression screws in place indicating that not suitable
for Locator attachments in over denture. A hybrid fixed
bridge using the existing implants was not advised as
this would have resulted in extremely difficult cleaning
issues.



Figure 31:
Special tray with windows for unscrewing the impression abutments during the impression.

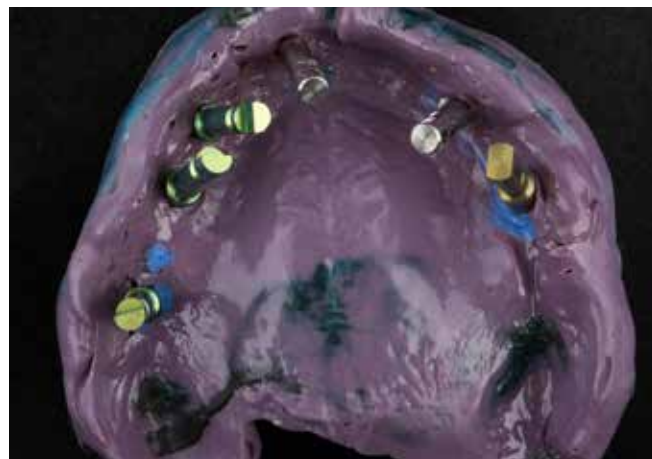


Figure 32:
Definitive maxillary impression Impregum (3M ESPE, USA), with fixture analogues in place.

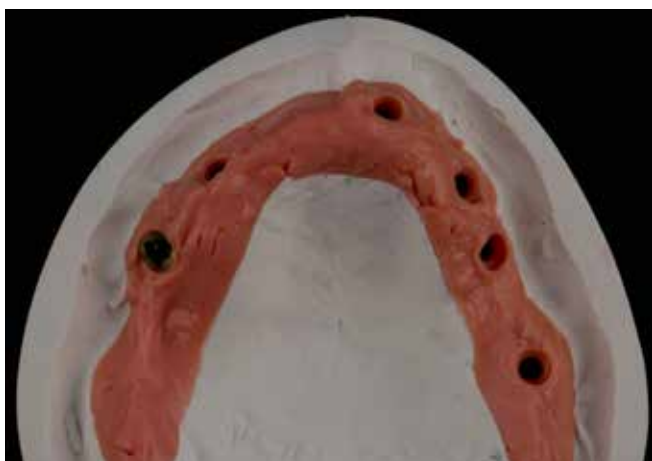


Figure 33:
Definitive maxillary cast with soft tissue model.



Figure 34:
Wax rim carved to prescribe the tooth positions with reference to the dentate photographs. Foxes bite plane - showing the incisal plane is parallel with the interpupillary line.

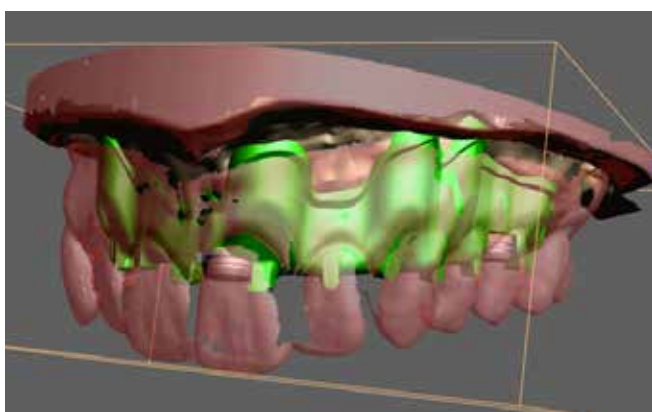


Figure 35:
The prosthetic 3D views were emailed to Rowan and I from Createch (Spain) to verify that the bar and sleeve could be fitted within the confines of the prosthesis.



Figure 36:
Milled titanium bar and Locator attachments incorporated.



Figure 37:
Titanium sleeve with locator housing attached and opaqued with Delta Link (Kuss Dental, Spain).



Figure 38. **enigmalive** teeth (Schottlander, UK) teeth positioned in the same position as the try in using a silicone index prior to wax up.



Figure 39:
Two sleeve dentures were constructed. These are worn on alternate days in order that the bar/sleeve/Locator attachments and teeth wear at similar rates. If one of the sleeve dentures has a catastrophic fracture this can be refurbished straight away. The other sleeve denture can be worn during this period and is totally comfortable and the patient is fully adapted to it.



Figure 40:
Bar fitted in the mouth.



Figure 41:
Sleeve denture fitted.



Figure 42:
Finished Upper sleeve denture with **enigmalive** teeth (Schottlander, UK) and lower ceramic zirconia bridge.



Figure 43:
Mandibular ceramic zirconia bridge fitted and sleeve denture with **enigmalive** teeth (Schottlander, UK) in maximum intercuspation.



Figure 44:
Finished case with mandibular ceramic zirconia bridge fitted and sleeve denture with **enigmalive** teeth (Schottlander, UK).