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August 2022
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Clinical Dentistry is committed to the advancement of practical clinical skills in dentistry. Through its focus on inspirational clinical casework, its sole aim is to help general dental practitioners enhance their skills and techniques across every facet of dentistry in an easy-to-assimilate and practical way.

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Printed by: Buxton Press
ISSN: 2752-3969

FUTURE-PROOF



Welcome to the August issue of *Clinical Dentistry*.

From new technology and materials to the science and research that drives them, modern dentistry abounds with fascinating advances across the field. But these advances aren't limited to the research lab – with in-person events back on the agenda, we are once again getting the chance to hear about some of these developments first-hand.

One such event was Europerio10 – held this year in Copenhagen, Denmark, in June – where progressions in periodontology and implant dentistry in particular were top of the bill. Organised by the European Federation of Periodontology, Europerio takes place every three years, and is regarded (understandably) as the world's leading congress in periodontology and implant dentistry.

This year's scientific programme focused on the present and future of the science and practice of periodontology and implant dentistry – including research on novel topics such as the role of artificial intelligence in diagnosis and treatment. It's progressive stuff, and I'm thrilled to have the lead author of the research, Muhammet Burak Yavuz, summarising the thought-provoking abstract on page 37.

Europerio10 also presented new evidence on previously investigated areas – such as the links between gum disease and heart conditions, diabetes, premature birth and lung function, and the long-term outcome of periodontal treatment. Even with these heady topics on the agenda, I think it's safe to say that the major focus for Europerio10 was something even bigger: the announcement of the first European guidelines on treating advanced (stage IV) periodontitis.

Complementing the previously published guidelines for treating stage I to III periodontitis (issued in 2020), this latest work completes the European recommendations for the interdisciplinary and evidence-based management of all stages of the disease.

Globally, approximately 1.1 billion people had severe periodontitis (stages III and IV) in 2019. The hope is that these clinical guidelines will improve the quality of periodontal treatment, and I'm delighted to share more with you all from the lead author, David Herrera, on page 92 of this issue.

This work, and these guidelines, have the potential to change lives, and it's an honour as much as a pleasure for us here at *Clinical Dentistry* to share them with you all. I hope you find the work as fascinating as we do!



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Meet the experts

Introducing some of the people who have shared their expertise and offered handy hints and tips throughout this issue of *Clinical Dentistry*



DANIEL FLYNN

Daniel Flynn offers two top tips for aiding endodontic treatment on page 54.

Daniel qualified dentistry with honours from Trinity College Dublin in 2002. He's on the specialist list for endodontics.

Daniel lectures and gives hands-on courses for dentists in the UK and abroad. Daniel has successfully run his own hands-on courses and online teaching programmes since 2012.

For further details, visit www.endouk.com.



PROFESSOR DAVID HERRERA

David Herrera answers questions on the latest European Federation of Periodontology (EFP) guideline on treatment of stage IV periodontitis on page 92.

David was scientific chair of Europeri10, chair of EFP's Perio Workshop, and lead author of the main paper on the new EFP guideline.

David is a full-time professor of periodontology, associate dean for clinics and co-director of the EFP-accredited postgraduate programme in periodontology, at University Complutense of Madrid, Spain.

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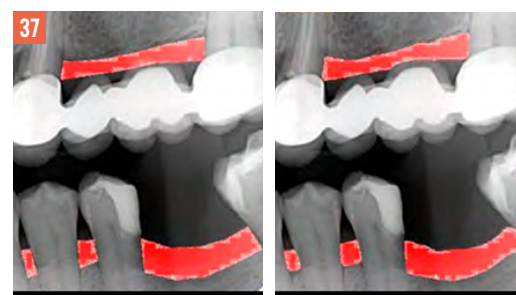
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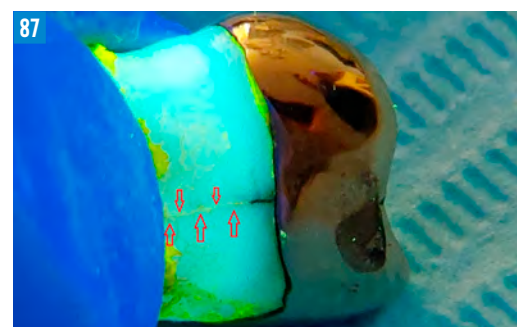
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DEVANG PATEL

Full mouth reconstruction:
part two

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Developing a long-term
relationship and communicating
with patients keeps them
informed about what could
happen to their teeth over time –
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**DR TIF QURESHI**

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Tif has a special interest in simple orthodontics and minimally invasive dentistry and pioneered the concept of Align, Bleach and Bond (ABB), and Progressive Smile Design. He is an experienced teacher of the Dahl concept, which assists with minimally invasive, patient-centred dentistry. Tif is a clinical director of IAS Academy and a past president of the British Academy of Cosmetic Dentistry. He graduated from King's College, London in 1992 and is a partner at Dental Elegance, Sidcup where he has worked for nearly 30 years.

ENHANCED CPD**GDC anticipated outcome: C****CPD hours: one****Topic:** Interceptive dentistry**Educational aims and objectives:**

To explore 'pausative' dentistry concept and the importance of adopting a lifetime approach. This article qualifies for one hour of enhanced CPD; answer the questions on page 110 or scan the QR code.



What does it mean to care for a patient over a lifetime? Are we, as dentists, treating a patient to make them happy and then saying goodbye, or should we provide that patient with a stable, functional outcome to last for many years?

By applying ortho-restorative principles to treat mild and moderate crowding cases, as well as improving appearance, we are potentially also carrying out interceptive functional treatment that can maintain a patient's long-term anterior guidance and a correct envelope of function.

The align, bleach and bond (ABB) approach provides the ability to reverse dental collapse and improve anterior guidance that, if left untreated, can lead to future problems. ABB is much more than aesthetic treatment. It is also functional and preventive and can change the way we approach all patients, not just cosmetic cases.

Being able to carry out Dahl build-ups is also important. When the Dahl technique is understood, it can be one of the most powerful tools in dentistry.

MONITOR, RETAIN OR TREAT?

I believe patients often agree to treatment when they do not really understand the functional advantages.

Would it be more helpful if patients who decided to have aesthetic and cosmetic dentistry really understood the functional and potential lifetime benefits of those treatments?

Developing a long-term relationship and communicating with patients keeps them informed about what could happen to their teeth over time.

Understanding the occlusal and functional effect of continued tooth movement enables the patient to make an informed decision about intervention. I believe that it is crucial we talk to patients, present

the facts and avoid rushing into treatment with veneers and crowns.

It is important to explain the slow minor positional, functional changes and educate the patient about what is happening in their mouths. I record the amount of dentine exposure and look very carefully at enamel chipping. I always explain that dentine is six to eight times softer than enamel and that it will stain more heavily.

Taking regular photographs of the patient is also important, even if no treatment is provided. Each time a patient presents, we can look at the images together to see the changes over time. I don't think dentists are taught or conditioned to take photographs often enough.

I will also undertake a regular fremitus check, demonstrating the pressure of fremitus and helping the patient understand what it means to have a constricted envelope of function.

The key issue is that we explain that the change is gradual and progressive; we observe, we do not panic. We offer to monitor, retain or, of course,

Developing a long-term relationship and communicating with patients keeps them informed about what could happen to their teeth over time

Tif Qureshi explains his 'pausative' dentistry concept and the importance of adopting a lifetime approach

Aesthetic, functional and affordable dentistry

treat. Patients gain an appreciation that, over time, teeth keep moving, become more crowded, collide and discolour.

The following case highlights the treatment of a patient over 17 years. With simple orthodontics, direct edge-bonding applied with the Dahl principle and a little maintenance, her teeth were prevented from becoming worse at a relatively low cost.

CASE PRESENTATION

A 48-year-old female came to see me in 2004. The patient initially presented because she was unhappy with her two discoloured upper central incisors (Figure 1).

She also had chipping and wear to the lower teeth and broken posterior bridgework. In addition, her bite felt uncomfortable (Figure 2).

On examination, she had reduced anterior guidance causing posterior interferences and heavy contacts behind the upper central teeth. The patient was keen to change the crown and

veneer on the upper centrals. She also wanted to treat the wear on her lower teeth and the crowding (Figure 3).

TREATMENT OPTIONS

Options discussed with the patient were comprehensive orthodontics versus a compromised plan. We also considered multiple upper and lower ceramic units versus alignment, bonding and replacing the two centrals (Figures 4 and 5).

Due to financial constraints and concern about the amount of tooth preparation needed, the patient chose simple anterior alignment with removable appliances. She opted for the Inman Aligner for alignment of the lower 3-3 teeth. Interproximal reduction (IPR) was carried out progressively over eight weeks.

Once her lower teeth were aligned, an indirect wire retainer was bonded into place. This was followed with direct edge-bonding on the lower teeth with the Dahl principle (Dahl and Krogstad,

1982), with primary contacts on the canines and light contacts on the incisors (Figure 6).

The occlusion was reviewed and readjusted about one month later to ensure any maximum intercuspation (MIP) and centric relation (CR) slide had been accounted for. The anterior contacts were readjusted and balanced at this point.

The two upper central units were replaced with a new ceramic crown and a veneer (Figures 7 and 8). The patient's bite settled over a two- to three-month period. The result was not perfect, but we were working within a limited budget. After about six years, the posterior bridge units in the lower arch were replaced at the patient's own speed.

COST-EFFECTIVE AND ATTAINABLE TREATMENT

Figure 9 shows the patient 13 years later in 2017 when the lower teeth are starting to wear. The upper central incisor units are still in place but the lower right central is almost completely worn (Figure 10). The patient didn't want to replace



FIGURE 1: 2004 – the patient was unhappy with the discoloured upper central incisors



FIGURE 2: 2004 – the patient's bite felt uncomfortable



FIGURE 3: 2004 – she also wanted to treat the wear on the lower teeth and the crowding



FIGURES 4 and 5: 2004 – multiple upper and lower ceramic units versus alignment, bonding and replacing the central incisors was discussed



FIGURE 6: 2004 – after alignment of the lower 3-3 teeth, direct edge-bonding with the Dahl principle was carried out



FIGURES 7 and 8: 2004 – the two upper central units were replaced with a new ceramic crown and a veneer



FIGURE 9: 2017 – after 13 years the lower teeth are starting to wear



FIGURE 10: 2017 – the upper central incisor units are still in place but the lower right central is almost completely worn



FIGURE 13: 2021 – the patient decided to have the two upper central units replaced with a lithium disilicate crown/veneer



FIGURES 11 and 12: 2017 – palatal platforms were placed on the upper canines using Kulzer Venus Diamond in Opaque Medium (OM) shade



all the lower composite at this stage as she was more concerned about improving the appearance of the upper central teeth, one of which had developed a hairline fracture.

Budget was still an issue, so for the time being we agreed to re-Dahl the teeth. However, this time palatal platforms were placed on the upper canines. This was completed using Kulzer Venus Diamond nanohybrid composite in Opaque

Medium (OM) shade (Figures 11 and 12). The palatal platforms were placed freehand and a simple flat surface was created that reproduces similar but more basic anatomy than a natural cingulum.

By placing a flat platform we could ensure correct axial loading. The contacts were balanced and checked with articulating paper. These platforms then provided enough room to clean

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FIGURES 14 and 15: 2021 – the upper palatal platforms created with Venus Diamond are still working and the repaired lower central incisal edge is still in position



FIGURE 16: 2021 – alignment and direct edge-bonding with the Dahl principle can help to minimise the amount of damage in long-term cases

and rebuild the incisal edge of the lower right central without having to remove any of the other original composite placed in 2004. Venus Diamond Opaque Light (OL) and B1 shades were used to build up the lower tooth. A base shade of OL was placed and B1 applied over the top.

I like the strength offered by Venus Diamond. I have been using the material for more than 12 years and it has proved to be very fracture resistant. The composite offers easy handling, is predictable and adapts perfectly to the colour of the teeth.

At this stage, if the patient's teeth had not been treated in 2004 there would have been further heavy wear on the dentine, probably one or two millimetres more tooth surface loss at a minimum, and increased crowding. A constricting envelope of function potentially would have caused one of the upper teeth to either break or push forward.

STRONG, DURABLE RESTORATIONS

In 2021, the patient decided to have the two upper central units replaced with a lithium disilicate crown/veneer (Figure 13). The upper

palatal platforms created with Venus Diamond in 2017 are still working and the repaired lower central incisal edge is still in position (Figures 14 and 15).

The original edge-bonding on the other lower teeth remains in place 17 years later.

To enhance the lower canines and incisors, the teeth were polished with the simple-to-use and predictable Kulzer Venus Supra polishing kit. However, it is likely that in the next two to three years they will all be replaced with Venus Diamond composite.

INTERCEPTIVE DENTISTRY

This case effectively demonstrates that the concept of 'pausative' dentistry can be aesthetic, functional and affordable. If this patient's teeth were left untreated from 2004, how would they look 17 years later?

The lower crowding would likely get worse (Little, 1999). The bite would probably deepen, causing more surface loss, as there were already signs of dentine exposure. The already reduced posterior guidance would likely worsen and more posterior teeth could fail.

The 'pausative' approach with alignment and direct edge-bonding with the Dahl principle can help to minimise the amount of damage in long-term cases (Figure 16). It can help prevent further tooth surface loss and tooth positional changes, and hold the occlusion in a much better position over time.

For me, the interceptive concept is where dentistry really should be heading. Perhaps we should all be thinking more about intercepting and preventing obvious issues becoming predictable problems later on. Within this approach, the goal could really be total lifetime care. 

ABB COURSE

The Dahl principle and the treatment of tooth wear is taught on Tif Qureshi's IAS Academy Align, Bleach and Bond (ABB) course held at IAS Academy, Weybridge. Next available dates: 23-24 September and 9-10 December 2022.

REFERENCES

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- Little RM (1999) Stability and relapse of mandibular anterior alignment: University of Washington studies. *Semin Orthod* 5(3): 191-204

PRODUCTS USED

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Full mouth reconstruction: part two

In the second of a series of three articles, **Devang Patel** discusses the various aspects of treatment planning a full-mouth rehabilitation case

In a series of three articles, I aim to give readers the knowledge to understand the process of direct adhesive full mouth reconstruction.

In the previous article, published in last month's *Clinical Dentistry*, we discussed some of the core principles of occlusion and the final occlusal scheme we would aim to achieve for our adhesive full mouth reconstruction.

In this article, we will discuss the various aspects of treatment planning.

COMPREHENSIVE ASSESSMENT

Any treatment planning starts with a comprehensive assessment. During this assessment, we are gathering data to help us plan the treatment. We need to find any warning signs from the beginning.

In addition, before you start any treatment, you need to make sure that you and the patient are both happy to work with each other. If the patient is not happy with you or if you are not happy with the patient, then I would strongly suggest that you do not start full mouth reconstruction.

You may find warning signs during the clinical examination, such as issues with the TMJ, including pain or limited/irregular movement, muscle pain, myospasm, wear facets, drifting, fracture, pain/sensitivity with teeth, the individual prognosis of teeth, condition of current restorations, unstable bite etc.

Finding the first point of contact and assessing the slide between centric occlusion (CO) to intercuspal position (ICP) is also very important if you are planning to reorganise the occlusion.

I have created an ebook to help dentists carry out a comprehensive clinical assessment, which includes general assessment, occlusal assessment, and implant assessment. To gain access, visit bit.ly/3xM7DkG.

FACEBOW RECORD

Facebow records the physical relationship of the maxilla, particularly the maxillary teeth to the condylar hinge axis of the mandible and the horizontal plane. Facebow helps in mounting models in an accurate relationship, replicating the patient's jaw movement, which also help assessment and treatment planning cases such as comprehensive and functional diagnostic wax-up. It helps us when we're doing full mouth reconstruction and we would like to mount patients' models in an accurate position.

Functions of a facebow:

- To record the physical relationship of the maxilla and particularly the occlusal surfaces of maxillary teeth both to the intercondylar hinge axis of the mandible and to the horizontal plane
- Transfer incisal/occlusal plane aligned with the interpupillary line
- Mount models centrally in the articulator

- Allows reproducible transfer (this is the main reason why I use facebows.)
- Allows maxillary cast verification
- Some facebows help measure intercondylar distance.

It helps in mounting models accurately to replicate the patient's jaw movement for assessment and treatment, such as:

- Comprehensive functional/aesthetic diagnostic wax-up
- Full mouth reconstruction
- Incorporating or changing guidance in restoration – canine, group function, protrusive guidance
- Complete denture
- Anterior open bite
- Michigan/Tanner splints.

CENTRIC RELATION RECORD

Many dentists find it difficult to record centric relation (CR) for patients. Using a leaf gauge is one of the easiest ways to record CR. However, if the patient is dysfunctional and difficult to guide, then it may be necessary to make a special deprogrammer such as the Kois deprogrammer and let them use it for a few days or weeks before recording the CR.

In some cases, it may be advisable to give the patient a Michigan splint before starting any treatment.

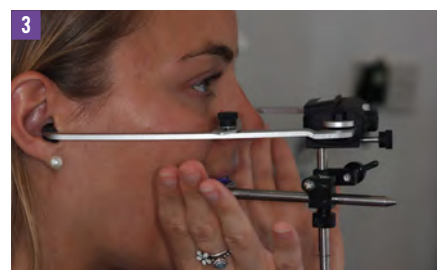
You will be required to mount models in CR in the following situations:

- To mount mandibular and maxillary models in CR
- Reorganised approach to restore teeth



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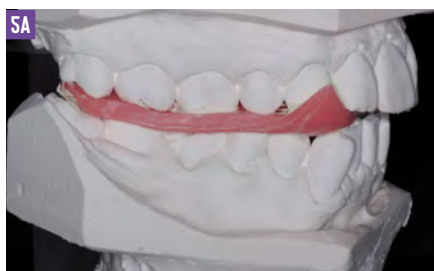




FIGURES 1, 2 and 3: Using a facebow



FIGURE 4: Recording the CR



FIGURES 5A and 5B: Michigan splint

(eg, full mouth reconstruction, changing OVD)

- Unstable bite
- Fabrication of Michigan splint.

You don't need an interocclusal record to mount models when a patient has:

- Stable bite and restoration do not involve reorganised approach or changing OVD
- Stable bite and mounting needed in ICP.

However, remember that you always need facebow record to mount any models on any decent articulator.

PATIENT-RELATED FACTORS AFFECTING TREATMENT PLANNING

We need to consider patient-related factors before beginning the journey of full mouth reconstruction. This is important even if you are treating a single tooth, but if you are carrying out full mouth reconstruction then the implication of misjudgement can be catastrophic for both the patient and the clinician.

Consider patient preferences, motivation, systemic health, emotional status, and financial capability.

DENTIST-RELATED FACTORS AFFECTING TREATMENT PLANNING

Dentist knowledge, experience, and training bear great significance. Generally, dentists tend to work very safely and do not go beyond their comfort zone without appropriate training. Hence, it can be safely surmised that, in general, dentists have received appropriate training before embarking on such type of treatment.

It is not possible to do this type of treatment by yourself and it is vital to have a good team of support staff and laboratory technicians.

It is also key that the dentist and the patient get along with each other. It is important to recognise any personality clashes before starting any complex case.

SPECIFIC FACTORS

1. Patient-related factors

- Can you meet the expectations of the patient?
- Will the patient be able to tolerate the treatment and then maintain the restorations?
- Your own skills: can you do this to a high enough standard?
- Can you justify the changes you are going to make to the patient's teeth?

2. Factors related to an oral condition

The oral environment:

- Can you, and the patient, control the environment to minimise the risk of disease or damage in the long term?
- Is the plaque control good enough?
- Has the risk of future caries risk been addressed?
- Has the risk of damage from the occlusion been minimised?

3. Tooth-specific factors

- Are the foundations biologically and biomechanically sound?
- Periodontal status. Is it an appropriate time to remove the tooth or carry out full mouth scaling and debridement and save them for some time?
- Is the endodontic state stable enough to allow a crown/onlay to be planned?
- Is the tooth itself strong enough to receive and retain a crown/onlay?

- Will the preparation be retentive enough or will you be able to isolate the tooth for adhesive onlay, if necessary, by doing deep marginal elevation?
- Is there sufficient space for my restoration?
- Are you extracting this tooth due to long term prognosis and advising implants or carrying out root canal treatment and saving the tooth?
- Teeth positioning. It is important that teeth are in an appropriate place for full mouth reconstruction, which is why nearly 70% of my full mouth reconstruction cases need orthodontic treatment. Sometimes you can get away without orthodontic treatment, but the patient needs to be fully aware that this may compromise the treatment.

In summary, ask yourself these fundamental questions: 'Will this patient's oral health be better off when I have finished?' and 'what will this dentition be like in 10 years?'

TREATMENT PLANNING QUESTIONS

Comformative versus reorganised?

Almost all full mouth reconstructions are reorganised due to the nature of the treatment. It is almost impossible to carry out full mouth reconstruction and maintain the original occlusion. Advantages of reorganising include:

- Removal of deflective contacts
- Preparation of teeth does not result in a change of jaw relationship since we reorganise using CR/CO as our starting position
- Greater control
- Stable occlusion, in harmony with border movements
- Iatrogenic deflective contacts are not introduced



FIGURES 6A and 6B: Wax-up

- Control over interocclusal contacts
- Posterior stability.

Do you need to raise occlusal vertical dimension?

Almost all reorganised cases may involve raising some occlusal vertical dimension (OVD). Raising OVD will allow restorative space and reduce any preparation of teeth for occlusal clearance. It also gives the clinician the ability to remove deflexive contact and correct the occlusal plane.

Are the teeth in the right place?

As discussed previously, this is a very important question each dentist should ask before considering full mouth reconstruction.

Orthodontic assessment should be carried out for all full mouth reconstruction patients. The aim is not only to get an aesthetic result but also to allow ease of restoration and occlusion by allowing appropriate positioning of the teeth.

How is the occlusal plane?

In general, we see a very steep or reverse curve of Spee in the wear cases due to severe wear and dentoalveolar compensation. A flat curve of Spee or curve of Spee with less curvature enables the clinician to create shallow anterior guidance in accordance with mutually protected occlusion and does not restrict the envelope of function for the patient.

PATIENT-RELATED QUESTIONS

General patient-related questions include:

- Can you both get along with each other?
- Can you fulfil the patient's goals?
- Is the patient compliant? Do they value what you are doing?

Is TMJ sound?

Load test of TMJ:

- If positive, then provide the patient with a Michigan splint and wait until it is not painful
- If no pain and easy to manipulate the jaw, then go ahead
- If no pain and difficult to manipulate the jaw, then provide a Michigan splint
- If unstable occlusion when the patient cannot locate their bite, then provide a Michigan splint.

What type of wear?

Pattern/extent of tooth wear:

- Decide if the wear is full mouth or localised
 - If you would like to use Dahl technique – anterior only wear cases
 - If you need ortho – if only posterior or anterior wear
- Determine upper anterior length to assess how much OVD needs increasing or can be increased. Sometimes, we need more space for posterior teeth, but we are always guided/limited by anterior teeth
- If lower anterior teeth need restoration then raising OVD is almost always a must.

Are there any limiting factors?

- Newly fitted crowns/veneers, which the patient may not want to change
- Crowns with post and core and substandard endo
- Existing implant restorations
- Crowding (may need ortho first)
- Severely supraerupted tooth (may need extraction under local anaesthetic or ortho)
- Finance.

Have you gained informed consent?

Inform the patient of the following:

1. Failures of RCT, implants, restorations in the long term
2. That restorations will not last a lifetime
3. Tell the patient that: 'You will break restorations' as you cannot control parafunctional habits
4. Tell the patient that: 'It will cost £XX to fix it after XX years', depending on your guarantee
5. Write an appropriately worded detailed treatment plan (not just an estimate) and gain consent.

Remember: if you tell the patient about potential complications before it happens then it's information/consent, but if you tell them afterwards then it's an excuse.

DIAGNOSTIC WAX-UP AND MOCK-UP

Once you have planned treatment you can then ask the technician to carry out a diagnostic wax-up.

Diagnostic wax-up helps in:

- Visualising end point, shape and contour of restorations
- Assessing patient expectations through mock-up
- Assessing planned occlusion and making necessary possible changes
- Assessing space for the tooth restoration needed
- Preparing guides for the preparation by taking index from wax-up
- Fabrication of provisional restorations.

Many dentists come to me with mounted models with diagnostic wax-up without being certain about the treatment plan. It is vital to know your treatment plan before you advise the technician for a wax-up.

If you are going to provide the patient with just onlay, then you need to tell the technician to add wax only on occlusal surfaces of the molars and not cover the whole tooth. Similarly, if you are just doing palatal and incisal build-up, then you need to let the technician know to not place wax on the buccal aspect of the anterior teeth, otherwise it may mislead the patient.

If you are not sure of the plan, ask the technician to mount models and assess articulated models before asking them to carry out wax-up. If you are doing digital articulation and wax-up then it is easy to make amendments.

Once you are happy with the wax-up, you can then carry out a mock-up using bis-acryl temporary crown and bridge material and check for function and aesthetics.

After you have tested your mock-up for at least a week and both you and the patient are happy, then you are ready to move on to step two of the full mouth reconstruction.

This article has focused on various aspects of treatment planning and risk management. In the next article, which will be published in the September issue of *Clinical Dentistry*, the sequencing of the full mouth reconstruction and the various steps involved will be discussed. [📄](#)

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RESOURCES

For more, the author has compiled resources including video demonstrations, ebooks, and templates, which can be found via bit.ly/3xM7DkG. In addition, the Facebook group 'Full mouth reconstruction for GDPs' hosts resources that readers may find useful.

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AESTHETIC DENTISTRY

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Managing challenging
whitening cases

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Tooth whitening is a fantastic treatment. Not only is it safe and effective, but it also starts to give a level of pride to patients who may be upset with the way their smile looks – Alif Moosajee, p25

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**DR ALIF MOOSAJEE**

Alif is the award-winning principal dentist at Oakdale Dental, a specialist dental practice in Leicester, and is also the author of *The Smiling Dentist*, a jargon-free book for patients about clinical dentistry. Alif qualified at Birmingham University in 2004 and has a particular interest in implant dentistry and digital dentistry. Alif is a general practitioner and is intent on maintaining and treating his list and developing long-lasting relationships with his patients. Committed to finding the win-win scenario for everyone, he understands that if he does the right thing by those he interacts with, then they will generally do the right thing by him. As a principal, Alif is committed to utilising his team to deliver the best possible care, relying heavily on his therapist and dental nurses to help his patients get the best possible treatment and experience.

ENHANCED CPD**GDC anticipated outcome: C****CPD hours: one****Topic:** Aesthetic dentistry**Educational aims and objectives:**

To explore how to overcome some technically demanding tooth whitening challenges. This article qualifies for one hour of enhanced CPD; answer the questions on page 110 or scan the QR code.



W

hen it comes to tooth whitening in my practice, we treat a variety of different age groups – and each one is treated differently.

As my focus is now limited to implant treatment, my patients are generally older than the ones seen by my associates who focus on composite bonding and Invisalign treatments. It is therefore important to differentiate how one manages patients' expectations to save yourself many headaches.

Time and care should be taken when going through the whitening details with patients and a tailored approach should be made when consenting patients, being mindful of different age groups and specific presentations that we see.

UNDERSTANDING COLOUR

Understanding colour in dentistry can greatly help to understand when whitening cases will be straightforward and when they will be more challenging. This greatly aids predictability.

It is first important to recap some of the basics about colour in dentistry.

Colour is made up of:

- Hue
- Chroma
- Value

The hue relates to the colour itself – is it red or blue or green?

The chroma is the intensity of the colour (for example, if you had a glass of water and poured one drop of blackcurrant juice into it, it has a low chroma, but as you add more juice, the concentration of that purple increases, and therefore the chroma increases).

The last aspect is value or brightness: if you were to desaturate a picture and show it as completely black and white, then the value would be assessed by going from white all the way to black, and all the shades of grey in between.

Let's look more closely at colour in dentistry. Tooth colour comes predominantly from dentine.

When people present for tooth whitening and the teeth are darker then they can normally be grouped into those who have yellow shades and those who have grey shades. We often use the term chromaticity to describe this.

In the same way that the prevailing colour comes from the dentine, the brightness of the tooth comes from the enamel and 'value' is the term that is used to describe this.

If we know that the chromaticity (the hue and chroma) comes from the dentine in the tooth and the value comes from the enamel and understand how these two factors together influence the colour, shade and character of the tooth, we can communicate those aspects to our patients much more accurately, so that they can understand easily what we are trying to achieve and why some cases may be more difficult than others.

So, who are these challenging patients?

CHALLENGE: OLDER PATIENTS

With older patients, the enamel is generally thinner and has worn over their lifetime, so it is not uncommon that the whitening result is not as predictable and as 'wow' as with younger patients.

The brightening (increase in value) of the teeth really comes from the enamel in the tooth, so if any defects are shown or if the enamel is thinner because of a lifetime of physiological or pathological wear, then the dramatic whitening improvements will be harder to achieve.

Other types of patients with whom you may have issues with are the ones with grey chromaticity. Some patients have dentine that exhibits a yellow hue while others are leaning towards the greyer dentine. These are very stubborn and take a lot longer to whiten, which should be communicated with patients preoperatively.

If you inform these patients in advance that they will likely need more gel than other patients to reach the same end results, then they will understand and not be disappointed, or potentially annoyed. Forewarned is forearmed!

Alif Moosajee explains how to overcome some technically demanding tooth whitening challenges

Managing challenging whitening cases



CHALLENGE: POOR ORAL HYGIENE

Of course, poor oral hygiene – with plaque and tartar everywhere – will always get in the way of good whitening results.

It is important to instruct patients who have a build-up of plaque and tartar to have thorough hygiene treatment before they have their whitening treatment carried out.

On a practical level, if the calculus build-up is so bad then any scans or impressions will be inaccurate and will result in trays that will not fit properly once the teeth are cleaned.

Furthermore, whitening gel will whiten the calculus in preference and hence will not be used for the whitening of the teeth themselves. Once patients understand this, they are only too eager to request a hygiene appointment.

CHALLENGE: HYPOPLASIA/HYPERPLASIA

Less common, but also very challenging, is treating patients with hypoplastic or hyperplastic teeth. I am seeing this more commonly these days and so talking to patients about it so that they can understand what's going on is very important.

I often try to explain that teeth are formed in two stages. First of all, a fibrous scaffolding is created that outlines the shape of the tooth and then the scaffold is mineralised. The perfect mixture of this mineralising matrix will form the beautiful and hard dentine and enamel as we know them. Unfortunately, sometimes this mineralisation process can be impaired, resulting in a recipe that either has too much mineral (hyperplasia) or too little mineral (hypoplasia).

However, when observed clinically, hypoplasia and hyperplasia look very similar. In order to be sure which one the patient is suffering with and to understand it better, it is necessary to extract the tooth and look at it under the microscope.

Obviously, this isn't appropriate, but the offshoot is that the teeth will often look brown and stained. They can also look opaque and will be less resistant to wear and caries. Whether they are hyperplastic or hypoplastic, the management is often very similar.

It's also important to note that these teeth are often very stubborn if we try to whiten them. It's important to communicate that, because of their colour, morphology and texture that would have been affected by the loss of the microanatomy, it will likely impair the end result.

INSTRUCTIONS TO PATIENTS

At our practice, much of the whitening is carried out by dental therapists. We, therefore, had to reach a consensus within the practice so that standardised protocols and instructions were being given to patients.



FIGURES 1A to 1F: Case study of an older patient

This has definitely improved the consistency of the results that we get, but it is still important to be able to identify challenging patients before we start to promise them fantastic results. After all, it's not the patient's fault if they are technically a difficult case. It's our responsibility to be able to communicate that to them.

Our patients are provided with Philips Zoom Daywhite or Nitewhite, depending on their preference and lifestyle, and given instructions to whiten daily for two weeks. I have found that with these more difficult cases, a minimum of three weeks is recommended. We sometimes suggest patients whiten for up to six weeks so that we can achieve an excellent result.

SAFETY

One of the key conversations to have with

patients is to reassure them that tooth whitening is safe when provided by a registered dental professional.

I still have patients attending appointments thinking that whitening will damage their teeth, so it is important to be able to reassure them that no macroscopic or microscopic damage will result from whitening and hence whitening for a longer period is a safe thing to do.

I also explain to patients that they should think of whitening as an ongoing treatment that they do once, but then maintain going forwards.

This also helps when patients ask how long the results will last, as you can shift the focus away from longevity towards them having a relationship with whitening, which will allow them to maintain those results over a lifetime, within reason.



FIGURES 2A and 2B: Before and after photographs of a patient whose oral hygiene is compromised



FIGURES 3A and 3B: Before and after photographs of a young patient

ZOOM WHITENING

I have used many tooth whitening systems and, to date, Philips Zoom whitening is my favourite. We really get beautiful results with it.

One of the many advantages with the Zoom system is that it's presented in a dual-barrel syringe. We advise patients that because the whitening gel is presented in a dual barrel, it is mixed as it is dispensed – therefore, the patient simply needs to inject a tiny dot into each scallop of the whitening tray. We also advise that the syringes do not need to be stored in a fridge.

We normally find that patients are very happy with the outcomes of this whitening regime. We have noted that their teeth are not only several shades lighter, but generally also have a healthy lustre. Furthermore, patients usually experience no sensitivity because of the presence of amorphous calcium phosphate (ACP) in the Zoom gel formulation, which acts as a very effective desensitiser.

Zoom whitening is also highly effective for older patients so long as we understand the challenges of compromised patients whose

enamel might be thin or who might show defects such as enamel hypoplasia or dentine hypoplasia, which affect both the quality and quantity of the enamel.

CONCLUSION

Tooth whitening is a fantastic treatment. Not only is it safe and effective, but it also starts to give a level of pride to patients who may be upset with the way their smile looks.

In addition, it helps make patients more involved in the care of their own mouths, which can only be a positive thing for them as patients and for us as dental professionals. This is why I'm such a keen advocate for making sure we can help our patients, especially those who are more technically demanding, to have a smooth journey. [GO](#)

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BOCOUTURE should only be administered by an appropriately qualified healthcare practitioner with expertise in the treatment of the relevant indication and the use of the required equipment, in accordance with national guidelines. The intervals between treatments should not be shorter than 3 months. Reconstitute with 0.9% sodium chloride. **Glabellar Frown Lines:** Total recommended standard dose is 20 units. 4 units into 5 injection sites (2 injections in each corrugator muscle and 1 injection in the procerus muscle). May be increased to up to 30 units. Injections near the levator palpebrae superioris and into the cranial portion of the orbicularis oculi should be avoided. **Crow's Feet lines:** Total recommended standard dosing is 12 units per side (overall total dose: 24 units); 4 units injected bilaterally into each of the 3 injection sites. Injections too close to the Zygomaticus major muscle should be avoided to prevent lip ptosis. **Horizontal Forehead Lines:** The recommended total dose range is 10 to 20 units; a total injection volume of 10 units to 20 units is injected into the frontalis muscle in five horizontally aligned injection sites at least 2 cm above the orbital rim. An injection volume of 2 units, 3 units or 4 units is applied per injection point, respectively. **Contraindications:** Hypersensitivity to the active substance or to any of the excipients. Generalised disorders of muscle activity (e.g. myasthenia gravis, Lambert-Eaton syndrome). Infection or inflammation at the proposed injection site. **Special warnings and precautions:** It should be taken into consideration that horizontal forehead lines may not only be dynamic, but may also result from the loss of dermal elasticity (e.g. associated with ageing or photo damage). In this case, patients may not respond to botulinum toxin products. Should not be injected into a blood vessel. Not recommended for patients with a history of dysphagia and aspiration. Caution in patients with botulinum toxin hypersensitivity, amyotrophic lateral sclerosis, peripheral neuromuscular dysfunction, or in targeted muscles displaying pronounced weakness or atrophy. Bocouture should be used with caution in patients receiving therapy that could have an anticoagulant effect, or if bleeding disorders of any type occur. Too frequent or too high dosing of botulinum toxin type A may increase the risk of antibodies forming. Should not be used during pregnancy unless clearly necessary. Should not be used during breastfeeding. **Interactions:** Concomitant use with aminoglycosides or spectinomycin requires special care. Peripheral muscle relaxants should be used with caution. 4-aminoquinolines may reduce the effect. **Undesirable effects:** Usually, undesirable effects are observed within the first week after treatment and are temporary in nature. Undesirable effects independent of indication include; application related undesirable effects (localised pain, inflammation, swelling), class related undesirable effects (localised muscle weakness, blepharoptosis), and toxin spread (very rare - exaggerated muscle weakness, dysphagia, aspiration pneumonia). Hypersensitivity reactions have been reported with botulinum toxin products. **Glabellar Frown Lines: Common:** headache, muscle disorders (elevation of eyebrow). **Crow's Feet Lines: Common:** eyelid oedema, dry eye, injection site haematoma. **Upper Facial Lines: Very common:** headache. **Common:** hypoaesthesia, injection site haematoma, application site pain, application site erythema, discomfort (heavy feeling of frontal area), eyelid ptosis, dry eye, facial asymmetry, nausea. For a full list of adverse reactions, please consult the SmPC. **Overdose:** May result in pronounced neuromuscular paralysis distant from the injection site. Symptoms are not immediately apparent post-injection. **Legal Category:** POM. **List Price:** 50 U/vial £72.00, 50 U twin pack £144.00, 100 U/vial £229.90, 100 U twin pack £459.80. **Product Licence Number:** PL 29978/0002, PL 29978/0005 **Marketing Authorisation Holder:** Merz Pharmaceuticals GmbH, Eckenheimer Landstraße 100, 60318 Frankfurt/Main, Germany. **Date of Preparation:** August 2021. **Further information available from:** Ground Floor Suite B, Breakspear Park, Breakspear Way, Hemel Hempstead, Hertfordshire, HP2 4TZ Tel: +44 (0) 333 200 4143

Adverse events should be reported. Reporting forms and information can be found at www.mhra.gov.uk/yellowcard for the UK. Adverse events should also be reported to Merz Pharma UK Ltd at the address above or by email to UKdrugsafety@merz.com or on +44 (0) 333 200 4143.

Ireland: Bocouture® (botulinum toxin type A (150 kD), free from complexing proteins) 50/100 unit vials*. Prescribing information: Please refer to the Summary of Product Characteristics (SmPC) before prescribing. **Presentation:** 50/100 units of Clostridium Botulinum Neurotoxin type A, free from complexing proteins as a powder for solution for injection. **Indications:** for the temporary improvement in the appearance of upper facial lines in adults below 65 years when the severity of these lines has an important psychological impact for the patient: moderate to severe vertical lines between the eyebrows seen at maximum frown (glabellar frown lines) and/or moderate to severe lateral periorbital lines seen at maximum smile (crow's feet lines) and/or moderate to severe horizontal forehead lines seen at maximum contraction. **Dosage and administration:** Intended for intramuscular injection. Unit doses for BOCOUTURE are not interchangeable with those for other preparations of Botulinum toxin type A. Bocouture may only be administered by physicians with suitable qualifications and the requisite experience in the application of Botulinum toxin type A. The intervals between treatments should not be shorter than 3 months. Reconstitute with 0.9% sodium chloride. **Glabellar Frown Lines:** Total recommended standard dose is 20 units. 4 units into 5 injection sites (2 injections in each corrugator muscle and 1 injection in the procerus muscle). May be increased to up to 30 units.

Injections near the levator palpebrae superioris and into the cranial portion of the orbicularis oculi should be avoided. **Crow's Feet lines:** Total recommended standard dosing is 12 units per side (overall total dose: 24 units); 4 units injected bilaterally into each of the 3 injection sites. Injections too close to the Zygomaticus major muscle should be avoided to prevent lip ptosis. **Horizontal Forehead Lines:** The recommended total dose range is 10 to 20 units; a total injection volume of 10 units to 20 units is injected into the frontalis muscle in five horizontally aligned injection sites at least 2 cm above the orbital rim. An injection volume of 2 units, 3 units or 4 units is applied per injection point, respectively. Paralyzing of lower muscle fibers by injecting BOCOUTURE near the orbital rim should be avoided to reduce the risk of brow ptosis. **Contraindications:** Hypersensitivity to the active substance or to human albumin or sucrose. Generalised disorders of muscle activity (e.g. myasthenia gravis, Lambert-Eaton syndrome). Infection or inflammation at the proposed injection site. **Special warnings and precautions:** if bleeding disorders of any type exist, in patients receiving anticoagulant therapy or other substances that could have an anticoagulant effect. Not recommended for patients with a history of aspiration or dysphagia. **Bocouture should be used with caution:** in patients suffering from amyotrophic lateral sclerosis, in patients with other diseases which result in peripheral neuromuscular dysfunction, in targeted muscles which display pronounced weakness or atrophy. Patients or caregivers should be advised to seek immediate medical care if swallowing, speech or respiratory disorders occur. Hypersensitivity reactions have been reported with Botulinum neurotoxin type A products. If serious (e.g. anaphylactic reactions) and/or immediate hypersensitivity reactions occur, appropriate medical therapy should be instituted. Too frequent doses may increase the risk of antibody formation, which can result in treatment failure. The potential for antibody formation may be minimised by injecting with the lowest effective dose given at the indicated minimum intervals between injections. Bocouture should not be used during pregnancy unless clearly necessary and unless the potential benefit justifies the risk. Bocouture should not be used during breastfeeding. **Undesirable effects:** Usually, undesirable effects are observed within the first week after treatment and are temporary in nature. Undesirable effects may be related to the active substance, the injection procedure, or both. Usually, undesirable effects are observed within the first week after treatment and are temporary in nature. Application related undesirable effects include localised pain, inflammation, paraesthesia, hypoaesthesia, tenderness, swelling, oedema, erythema, itching, localised infection, haematoma, bleeding and/or bruising may be associated with the injection. Needle related pain and/or anxiety may result in vasovagal responses, including transient symptomatic hypotension, nausea, tinnitus and syncope. Undesirable effects of the substance class Botulinum toxin type A include localised muscle weakness is one expected pharmacological effect of Botulinum toxin type A. Blepharoptosis, which can be caused by injection technique, is associated with the pharmacological effect of Bocouture. **Toxin spread:** when treating other indications with Botulinum toxins, undesirable effects related to spread of toxin distant from the site of administration have been reported very rarely to produce symptoms consistent with Botulinum toxin type A effects (excessive muscle weakness, dysphagia, and aspiration pneumonia with a fatal outcome in some cases). Undesirable effects such as these cannot be completely ruled out with the use of Bocouture. **Hypersensitivity reactions:** serious and/or immediate hypersensitivity reactions including anaphylaxis, serum sickness, urticaria, soft tissue oedema, and dyspnoea have been rarely reported. Some of these reactions have been reported following the use of conventional Botulinum toxin type A complex either alone or in combination with other agents known to cause similar reactions. **Glabellar Frown Lines: Common:** headache, muscle disorders (elevation of eyebrow). **Crow's Feet Lines: Common:** eyelid oedema, dry eye, injection site haematoma. **Upper Facial Lines: Very common:** headache. **Common:** hypoaesthesia, injection site haematoma, application site pain, application site erythema, discomfort (heavy feeling of frontal area), eyelid ptosis, dry eye, facial asymmetry, nausea. For a full list of adverse reactions, please consult the SmPC. **Overdose:** Symptoms of overdose Increased doses of Botulinum neurotoxin type A may result in pronounced neuromuscular paralysis distant from the injection site with a variety of symptoms. Symptoms may include general weakness, ptosis, diplopia, breathing difficulties, speech difficulties, paralysis of the respiratory muscles or swallowing difficulties which may result in aspiration pneumonia. In the event of overdose, the patient should be medically monitored for symptoms of excessive muscle weakness or muscle paralysis. Symptomatic treatment may be necessary. Respiratory support may be required if paralysis of the respiratory muscles occurs. Chemical and physical in-use stability has been demonstrated for 24 hours at 2 °C to 8 °C. From a microbiological point of view, the product should be used immediately. If not used immediately, in-use storage times and conditions prior to use are the responsibility of the user and would normally not be longer than 24 hours at 2 °C to 8 °C, unless reconstitution has taken place in controlled and validated aseptic conditions. **Legal Category:** POM. **List Price:** Ireland: 50 U/vial €81.00, 50 U twin pack €162.00, 100 U/vial €162, 100 U twin pack €317.30. **Market Authorisation Number:** PA 1907/003/001, PA 1907/003/002 **Marketing Authorisation Holder:** Merz Pharmaceuticals GmbH, Eckenheimer Landstrasse 60318 Frankfurt/Main, Germany. **Further information available from:** Merz Pharma UK Ltd., Ground Floor Suite B, Breakspear Park, Breakspear Way, Hemel Hempstead, Hertfordshire, HP2 4TZ. Tel: +44 (0) 333 200 4143.

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*Botulinumtoxin type A, purified from cultures of Clostridium Botulinum (Hall strain)²

M-BOC-UKI-0209 Date of Preparation: June 2022

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Direct vertical dimension increase with impressions

Marcelo Balsamo describes the approach the clinical procedure for oral rehabilitation with long-lasting success can take if the vertical dimension of occlusion is classed as compromised

Functional disorders can result in excessive loss of dental hard tissue, further resulting in loss of the vertical dimension of occlusion (VDO) over time. This can consequently be detrimental to the long-term success of an aesthetic restoration.

In the case described in this article, the bilateral balanced occlusion was severely compromised.

This should be viewed as a serious risk of failure with regard to the planned anterior restorations with ceramic veneers.

This study describes the approach the clinical procedure for oral rehabilitation with long-lasting success can take if the vertical dimension of occlusion is classed as compromised.

In such cases, direct restorations with the thermoviscous bulk-fill composite Viscolor bulk (Voco) and the help of the silicone impression technique in the form of a function-oriented template can contribute to long-lasting success.

CASE DESCRIPTION

Medical history

A middle-aged male patient presented at the dental practice complaining of 'fracture sites on the upper teeth', which were 'becoming worse every year'.

He did not report any pain; it was more the aesthetic aspect that had been the main problem for the patient for some time already.

His medical history was normal.



FIGURE 1: Initial situation – enamel fractures on the anterior teeth as well as multiple and severe instances of attrition, abrasion and erosion



FIGURES 2A and 2B: There are serious defects in some areas of the posterior teeth from the existing dysfunction

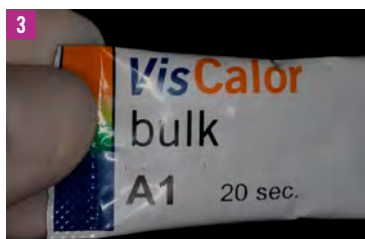


FIGURE 3: A thermoviscous bulk-fill composite (Viscolor bulk) is applied to the molars for the purposes of direct restoration, in accordance with the manufacturer's instructions for use ('repair of enamel defects'). It is also intended to restore the vertical dimension of occlusion



FIGURE 4: In accordance with the evaluations for the vertical dimension increase, a wax-up was produced, from which a customised impression made of transparent silicone (Registrado Clear) was created. This allows the intraoral transfer of the wax-up information from the articulator



DR MARCELO BALSAMO

Marcelo graduated with a degree in dentistry from the University of São Paulo, Brazil in 1989. He received his MSD and DDS in restorative dentistry from the São Paulo State University (UNESP) in 2001 and 2004, respectively. He is technical scientific consultant at Voco.

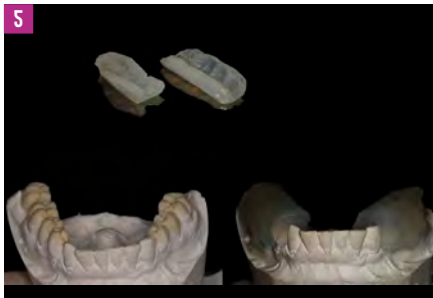


FIGURE 5: Silicone impression (Registrado Clear) for transfer of the wax-up simulation



FIGURE 6: All areas of the teeth involved in this process must be roughened to produce a retentive surface



FIGURE 7: Enamel-etch technique (Vococid)



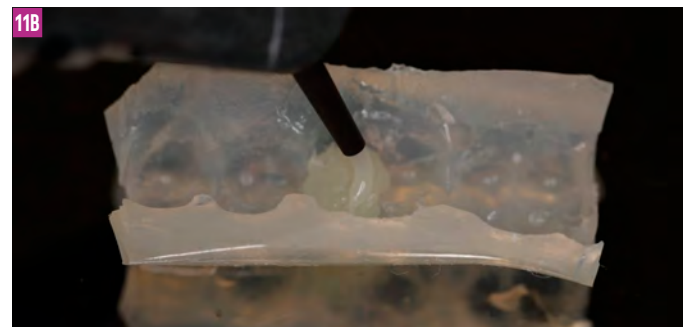
FIGURE 8: Bonding agent (Futurabond U)



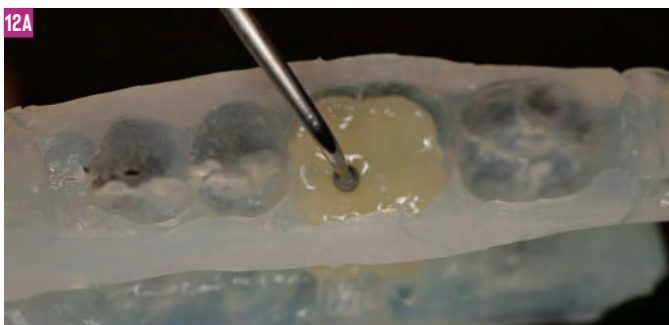
FIGURE 9: Light-curing of the adhesive layer



FIGURE 10: The silicone impression is produced from the lab's diagnostic wax-up and aids the dentist with the clinical orientation



FIGURES 11A and 11B: Viscolor bulk is applied to the silicone impression in a flowable consistency following warming in the special Viscolor dispenser



FIGURES 12A and 12B: The consistency changes during the cooling phase, with Viscolor becoming increasingly packable. Pressing the silicone impression gently against the dental arch makes it possible to completely reproduce the occlusal areas in just one step



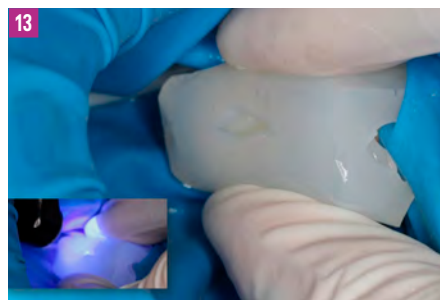


FIGURE 13: The silicone impression is pressed gently against the teeth and light-cured for 10 seconds, which facilitates the removal of excess composite (tack curing). The final light-curing is then performed for a further 10 seconds in accordance with the instructions for use for the Universal shade



FIGURE 14: Preliminary results following repair of the enamel defects. The buccal and lingual surfaces still need to be finished



FIGURE 15: Occlusal view of the posterior teeth in the mandible following build-up and prior to finishing and polishing. Unlike with a conventional direct restoration, the silicone impression technique does not require the time-consuming removal of excess material, especially on the occlusal surfaces. This consequently requires less effort on the part of the dentist during the finishing



FIGURES 16A and 16B: Before and after comparison. Situation following vertical dimension increase with direct restorations



FIGURE 17: The occlusal adjustment should naturally be performed directly after restoration of the bilaterally supported occlusion



FIGURE 18: As there is more space available between the incisors in the anterior region following the vertical dimension increase, the fractured and abraded areas can initially be temporarily restored



FIGURE 19: The restored VDO permits the temporary restoration of the defect areas in the anterior region (here with Admira Fusion). The permanent restoration with ceramic veneers should not be performed until weeks after the completion of the familiarisation phase



FIGURE 20: Situation prior to treatment of the anterior region with permanent restorations



FIGURE 21: Permanent anterior restorations in mandible and maxilla with ceramic veneers (IPS E.max)

Diagnosis

We diagnosed loss of vertical dimension of occlusion (VDO) with associated defects in the posterior region, resulting from parafunctional habits.

In addition, we identified enamel fractures on all upper and lower anterior teeth, as a result of different chemical and physical influences.

Result

The vertical dimension increase with direct composite restorations using silicone impressions is an easy-to-use, cost-effective, and efficient technique.

It is for these reasons why I believe it should always be considered as a treatment option by a dental professional. [CD](#)

PRODUCTS USED

IPS E.max Ivoclar
Viscocal bulk, Registrado Clear,
Vococid, Futurabond U, Admira Fusion
Voco

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*Curasept ADS 220, Perio & Implant are Medical Devices

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DIGITAL DENTISTRY

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Entry into digital workflows enhances what you do and how you do it. The jump from analogue dentistry into digital opens the door to a plethora of opportunities – Dan Shaffer, p40

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**MUHAMMET BURAK YAVUZ**

BCHD MJDF RCS ENG PGCERT MSC

Muhammet Burak is a periodontal researcher at Eskisehir Osmangazi University, Faculty of Dentistry, Department of Periodontology, Eskisehir, Turkey.

On the occasion of the Europerio10 congress, organised by the European Federation of Periodontology (EFP) in Copenhagen over 15-18 June, I presented the abstract 'Detecting periodontal bone loss with an artificial intelligence approach on dental bitewing radiographs', in the framework of the session 'Periodontal diagnosis and disease progression'.

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is a field of computer science that uses different techniques to create systems that mimic human intelligence. It is known that the potential of AI systems in the medical field is increasing day by day.

In parallel with the developments in the medical field, the use of these systems in the processing and interpretation of dental radiography images has become popular in the field of dentistry and is

among the current approaches of dentistry today.

When the literature is examined, it is seen that the success of AI systems in various studies is evaluated in many pathologies detection, such as impacted teeth, caries, tooth root fracture and apical lesion detection from different dental radiography images.

In addition, there is evidence that AI systems can be used easily and successfully for many purposes, such as tooth numbering and anatomical landmark detection. All these developments have made it inevitable to increase the number of technological-based initiatives aiming to produce solutions with AI systems in the dental field.

When both academic and technological developments are examined, there are limited studies and evidence for the determination of periodontal diseases, which are accepted as one of the most common diseases in the world, with these systems.

ENHANCED CPD

GDC anticipated outcome: C

CPD hours: one

Topic: Digital dentistry

Educational aims and objectives:

To summarise an artificial intelligence solution presented at Europerio10 automatically detects periodontal disease from bitewing radiographs. This article qualifies for one hour of enhanced CPD; answer the questions on page 110 or scan the QR code.

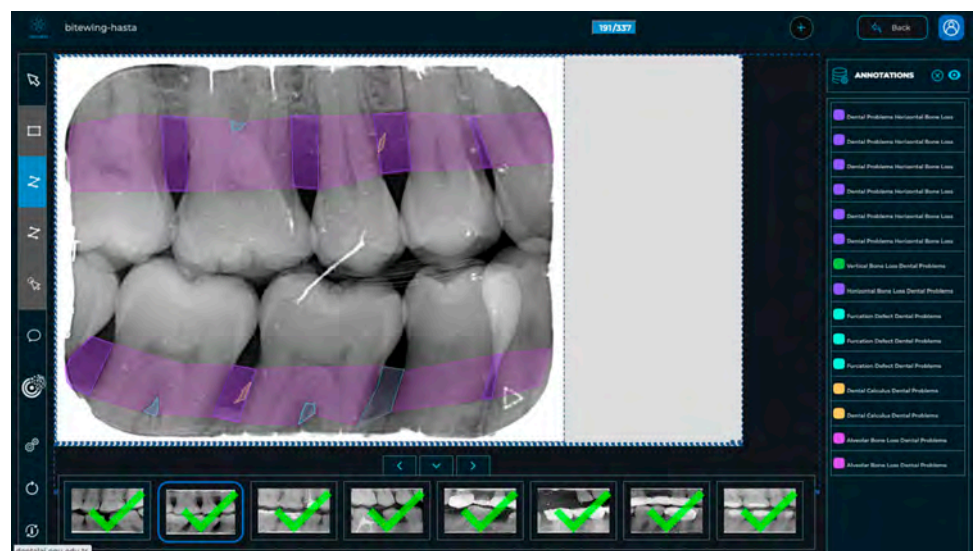


FIGURE 1: Craniocatch labeling module

Muhammet Burak Yavuz summarises his artificial intelligence solution presented at Europerio10 automatically detects periodontal disease from bitewing X-rays

Detecting periodontal disease with AI



As we realised this shortcoming, my research team and I decided to work in the field of periodontology and to find solutions with deep learning algorithms. My teammates are developing software called Craniocatch as an AI solution in dentistry and are already actively working on this issue.

Simultaneously with the studies we carry out in many areas of dentistry, many of our studies – such as periodontal disease detection, classification and bone loss determination in 2D radiography images (such as panoramic, periapical, bitewing radiography) and in 3D radiography images (CBCT) – continue.

In addition, we carry out studies for the automatic determination of periodontal and mucogingival status with the help of AI from digital dental photographs.

STUDY

Based on this information, our last study aimed to evaluate the success of the system in the determination of periodontal status in bitewing radiographs by using deep learning algorithms, which is an AI system.

This study has both clinical and academic importance in terms of automatic evaluation of bitewing radiographs used in dental caries detection with AI systems and early detection of findings suggesting the presence of periodontal disease.

The labelling module of Craniocatch software was used in this study to determine periodontal status from bitewing radiographs (Figure 1), which is one of the 2D dental radiographs.

In the study, 434 dental bitewing images obtained from the archive of the department of oral and maxillofacial radiology at the Eskisehir Osmangazi University were loaded into the labelling module. Total alveolar bone losses observed around the lower and upper jaw teeth in all radiographic images, horizontal bone losses, vertical bone losses, furcation defects and calculus were labelled by an experienced specialist with the segmentation method.

These labels were carried out in the Dental AI Laboratory of Eskisehir Osmangazi University, Turkey. This AI laboratory provides the opportunity to make central, safe and accurate evaluations on data.

After the labelling, all images were resized and adjusted prior to the training. Datasets in the form of training, validation and testing were separated for the development of AI systems. While creating AI models, U-net architecture was assisted and confusion matrix system was used for all statistical evaluations.

The gold standard in the evaluation of radiography was based on the evaluations made by an experienced specialist physician. U-net



FIGURE 2: Horizontal bone loss – real versus prediction



FIGURE 4: Alveolar bone loss – real versus prediction

architecture is a convolutional neural network (CNN)-based AI architecture. It is one of the image segmentation techniques that enables the evaluation of images in the medical field with AI systems, and provides a more precise and successful evaluation with less training sets. Therefore, in the current study, image processing was performed using the U-net architecture.

When the success of the system in the detection of total alveolar bone loss, horizontal bone destruction, calculus and furcation defects was evaluated, the F1 score was found to be 0.96, 0.95, 0.82 and 0.66, respectively; but the system could not determine the vertical bone destructions.

The results of the present study show that these systems can be used for periodontal status determination in 2D intraoral/extraoral dental radiographs and 3D radiographs in the future.

In order to increase the success of the models, more comprehensive studies are required on larger datasets. Our more comprehensive studies on this subject continue.

These systems provide the opportunity to automatically identify periodontal pathologies that may be missed from different types of radiographs. In this respect, it prevents treatment delay and the silent progression of diseases such as periodontal diseases.

It also exposes patients to less radiation by preventing repetitive radiography demands in cases that cannot be diagnosed due to inexperience. The regular registration system and reporting facilitates patient follow-up.

MAIN CONCLUSIONS

Our studies support the following conclusions:

- They are systems that assist the physician in diagnosis and treatment planning



FIGURE 3: Dental calculus – real versus prediction

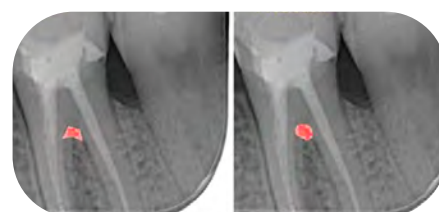


FIGURE 5: Furcation defect – real versus prediction

- Provides decision-support mechanism for physicians
 - Physician density prevents/minimises errors that may arise from fatigue or lack of experience
 - It allows the establishment of regular clinical record and reporting systems
- In short, it guides the physician in protecting and maintaining health.

By presenting this study as an oral presentation at this year's Europerio10 congress held in Copenhagen, we had the chance to show dentists that AI can be used in the field of periodontology. [\[4\]](#)

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RESEARCH TEAM

The research project team comprised:

Muhammet Burak Yavuz, Nichal Sali, Mehmet Meriç Ersöz, Sevda Kurt Bayrakdar, Ibrahim Sevki Bayrakdar, Özer Çelik and Kaan Orhan.

The authors have declared no conflict of interest. The work has been supported by Eskisehir Osmangazi University Scientific Research Projects Coordination Unit.

EUROPERIO10 KEY STATS

- More than 7,000 participants from more than 100 countries
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- 41 scientific sessions on emerging issues of interest for practitioners, scientists and academics
- More than 130 speakers from 30 countries.

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Going digital: considerations

Dan Shaffer explores digital dentistry, and the best place to start when it comes to buying an intraoral scanner

Digital intraoral scanners come in all shapes and sizes with varied functionality and connectivity. One thing is for sure though, entry into digital workflows enhances what you do and how you do it. The jump from analogue dentistry into digital opens the door to a plethora of opportunities.

The most precious resource in modern dental practice that bothers all of us is time. For dentists, time is at a premium.

Efficiency is a prerequisite to successfully navigating being a small business owner while providing excellent levels of clinical care.

The pressures on dentists encompass not only seeing swathes of patients, caring for their needs by providing treatments, but also being swamped by compliance, HR and business processes (Johns and Jepsen, 2015).

Who would have thought when exiting dental school that actual dentistry would only comprise a fraction of what we are expected to contend with in our everyday working lives?

ENHANCING TREATMENT

So, what can digital scanners offer us? Digital dentistry is a tool just like any other tool or treatment modality that we have in our armoury, ready to enhance what we do and how we do it.

Let's spare a thought for any other mode of treatment delivery that we utilise in our busy clinics. Whether it is endo or oral surgery, we get the appropriate equipment and expertise to use these tools for our patients' benefit.

We attend hours of courses and ensure that we use everything we've acquired to the best of our abilities in an

appropriate way to maximise efficiency and optimise our clinical results.

We keep our patients fully informed about relative risk, costs (both financial and biological) and ensure that the benefits of that specific procedure are highlighted (of course, not exceeding realistic expectations of chance of success balanced against risk of failure).

This is all couched in the reality that what patients are expecting might exceed our confidences and abilities.

How should we be explaining all of this to our patients? According to our regulators, it should be in a way that is objective, subjective and verifiable.

Introducing our biases to the decision making process for one treatment type over another can be seen as coercion. This is the Achilles heel of the modern dentist.

We all shout from the rooftops about how we would never willingly coerce a patient into one treatment over another.

Many patients who are referred to endodontists will be pre-screened to favour saving a tooth. How many endodontists recommend extracting teeth rather than carry out an endodontic procedure?

Most patients who are referred to an oral surgeon would be pre-selected to have teeth extracted before even meeting the surgeon. How many oral surgeons recommend trying to save the tooth?

Do our specialities give our biases away?

When you consider going digital, your first thought might be to get a scanner and include it in your armoury of tools ready for any staff member to roll out at a moment's notice.

Scanning every patient that walks in

through the door might be misconstrued as a loaded objective to recoup a high initial financial outlay.

On the other hand, it is surely advantageous for patients to have their dentitions scanned for many reasons.

These include:

- Clinical insight
- Education
- Record retention
- Treatment option visualisation.

Collection of vast amounts of data that will require extensive management to ensure its integrity, safeguarding and interpretation should be treated with caution.

WHICH SCANNER SHOULD I BUY?

When it comes to choosing a scanner, use a tool that is freely available on the internet (such as the Scan Club website) to ensure that you are being steered in the right direction.

Numerous dental companies now manufacture scanners – Dentsply Sirona, Medit, Carestream, 3shape and Planmeca all have offerings. While it might be tempting to ask which is the best scanner, each will have its advantages and disadvantages for different clinicians in different clinical scenarios.

In the words of one of my mentors, a clinical tutor at GKT (the medical school of King's College London): 'One dentist might take a better analogue impression using chocolate cake and Tupperware than another might take using the most expensive impression material and a special tray. What works in my hands might come over as gobbledygook in yours.'

Each dental equipment manufacturer will favour their own equipment over



DAN SHAFFER

Dan is an experienced dentist who has a passion and flair for all things digital. His dental practice, a private digital restorative practice in Hertfordshire, is well respected in the area by patients and dental professionals alike. He manufactures the vast majority of dental restorations in-house and also runs a full-service dental laboratory. Being a registered technician as well as a practising dentist gives Dan a special insight into technically demanding cases both from the laboratory and clinical points of view.



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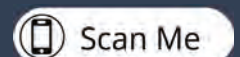
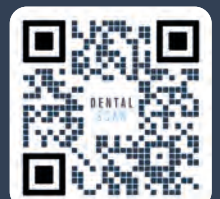
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others; they will shout from the rooftops about the specific research that backs up their claims of extreme accuracy/usability/ functionality over all others. Listen to what they have to say and consider taking advice from independent sources.

KNOWLEDGE IS POWER

In my opinion, the leading provider of education in digital dentistry is the International Digital Dental Academy (IDDA) Scan Club.

The founders of the IDDA – Adam Nulty, Chris Lefkaditis, Patrik Zachrisson and Quintus Van Tonder – lead the way to digital enlightenment. Talk to any one of them and they will gladly extol the virtues of one software or technique to enhance what you do.

Scan Club will help you demystify your needs as a clinician, while helping you to identify which scanner will be appropriate for you. The freely offered advice is given without affiliation to any company by practising dentists who use multiple scanners on a daily basis.

FIRST STEPS

The final piece of the puzzle is what to do with your scanner once it arrives and how it can generate income. The scanner will pay for itself in terms of its efficiencies.

A simple procedure to use it for will be to scan a single unit crown prep with an opposing arch and bite and send it to a lab.

The other workflow that is simply too good to miss is the full arch scan, which can then be used for clear aligner treatment plans.

I am clinical director for Active Aligners, a clear aligner company that, from its very beginnings, has considered the technical and clinical aspects in great detail (after all, I am a technician and a dentist). Active Aligners accepts scans from any scanner (polyvinyl siloxane [PVS] is also accepted).

Digital scanning is a non-AGP procedure that is very a la mode; you just need to let your patients know that you are providing this treatment modality.

The American Association of Orthodontists

claims that 50 to 75% of people could benefit from orthodontic treatment.

I believe, when you inform your patients that you are offering cosmetic straightening of teeth using clear aligners, they are keen to know more. They have seen adverts on social media and have heard about more expensive options. It would seem that they are just waiting for a dentist to offer them this treatment at an affordable price. If you offer them the opportunity for smile improvement at an affordable price, they will take you up on the offer.

In my opinion, the best way to start your digital dentistry journey is by joining Scan Club, getting educated about digital workflows by experts and providing clear aligners to your patients. [CD](#)

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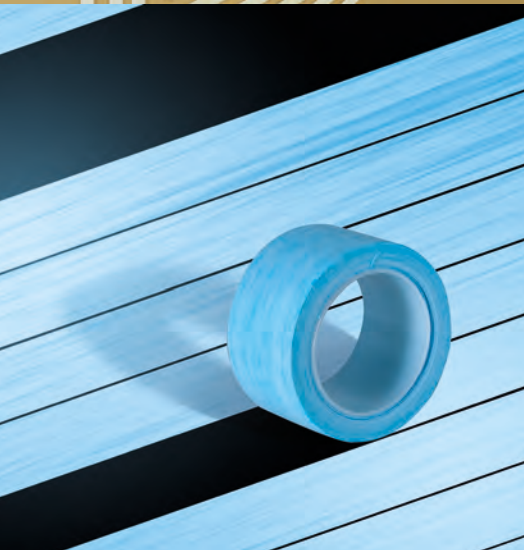
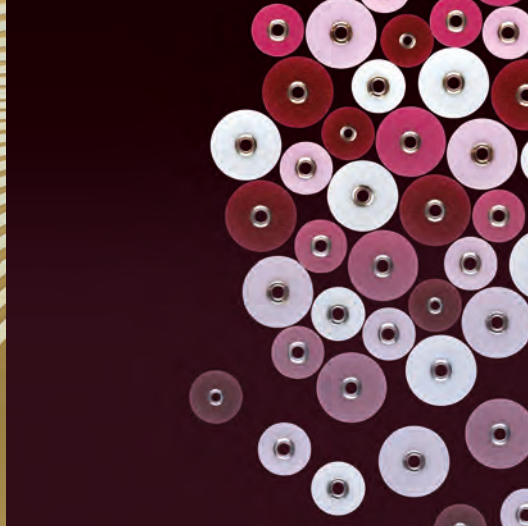


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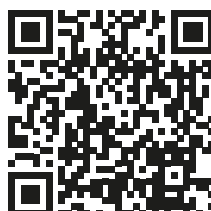
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DDS MS PHD

Pierre has limited his practice to endodontics since 1978. He is Professor Emeritus at Paris Diderot University, France.

**JOHN WEST**

DDS MSD

John is founder and director of the Center of Endodontics, Washington, US.

**CLIFFORD J RUDDLE**

DDS

Clifford is founder and director of Advanced Endodontics and maintains a practice limited to endodontics in California, US.

ENHANCED CPD**GDC anticipated outcome: C****CPD hours: one****Topic:** Endodontics**Educational aims and objectives:**

To explore the significance, rationale, and benefit of deep shape in endodontics. This article qualifies for one hour of enhanced CPD; answer the questions on page 110 or scan the QR code.



The goal of endodontic treatment is to prevent or cure, when present, lesions of endodontic origin, at times referred to as apical periodontitis. The role of bacteria in the pathogenesis of endodontic disease is well established, and therefore, it is critical to eradicate these pathogens by employing the highest level of presently developed standards.

This goal is clinically accomplished by shaping, cleaning, and filling root canal systems. These three pillars are often referred to as the endodontic triad or, in modern terms, the endodontic trifecta.

THE ROLE OF DEEP SHAPE IN ENDODONTIC PREPARATIONS

Grossman (1970) described mechanical cleaning as the most important part of root canal therapy. Later, Byström and Sundqvist (1981) could show the efficacy of mechanical instrumentation alone, without antiseptic irrigants and intracanal dressings, to reduce the bacterial load of infected root canal systems. In 1985, the same authors demonstrated that the best results could be achieved with the combination mechanical debridement/antiseptic irrigation with NaOCl, hence the frequent use of the term 'chemo-mechanical preparation' (Byström and Sundqvist, 1985).

It is biologically sound that sufficient mechanical instrumentation of the root canal system is necessary for debridement of all organic material, including predentine, and to allow the penetration and exchange of the irrigating solutions within the root canal system. The only way to create sufficient space in the apical region, without damaging this critical and delicate anatomic area, is to implement a precise deep shape preparation, ie, maintaining the apical extent of the root canal as small as practical with sufficient taper behind the physiologic terminus to allow the deep placement of the irrigating needle and irrigant agitation.

It is striking to notice that, as early as 2001, the Protaper shaping system (Dentsply Sirona) had

heralded finishing files with progressive tapers of 7%, 8%, and 9% in their apical 3mm of root canal preparations to cut a deep shape, followed by regressive tapers up to D16. The increased apical taper also provides access to the apical anatomy by shortening the length of lateral canals, therefore improving access to their cleaning.

The recently launched Protaper Ultimate endodontic shaping system (Dentsply Sirona) keeps the legacy of this iconic feature, with the addition of a more conservative coronal preparation to respect, without compromise, the current minimally invasive endodontic (MIE) (Figure 1) preparation concept and trend.

Indeed, the apical third is considered a critical zone because it is the most difficult part to clean and disinfect (Zahner, 2006). The anatomical complexity of this apical area with fins, isthmuses, and ramifications represents a real niche, harbouring the most harmful microorganisms and biofilms (Arnold, Ricucci and Siqueira, 2013). Therefore, from a biological point of view, it would make sense to create apical preparations with larger sizes to optimise debridement and irrigation (Kerekes and Tronstad, 1979).

As early as 1961, Ingle proposed a standardised technique with the then newly launched standardised endodontic instruments for the purpose of filling the apical third of the root canal initially with a silver point but later with a gutta percha cone matching the exact diameter of the last instrument used at the working length.

Increasingly sized reamers were successively used at the same working length to create a wide cylindrical preparation involving the whole canal cross section in order to mechanically clean it and, at the same time, provide a retention form with an apical stop to confine the filling material inside the root canal preparation.

This technique, initially developed by the University of Washington in Seattle, was quickly adopted by many dental schools. This standard was considered the reference technique for many years.

Pierre Machtou, John West and Clifford J Ruddell discuss the significance, rationale and benefit of deep shape in endodontics

Deep shape in endodontics



Following Kerekes and Tronstad's (1979) studies, in 1991, Ørstavik, Kerekes and Molven were the first to advocate extensive reaming in the apical region to reduce the endodontic source of bacterial infection. This was confirmed by Dalton and colleagues in 1998, who showed that the bacterial count was reduced with larger instruments sizes. According to Card and colleagues (2002), instrumentation of molars to size 60 and cuspids/bicuspids to size 80 showed that 81.5% of molars and 100% of cuspids/bicuspids were rendered bacteria-free at the end of the first appointment.

In addition to bacterial reduction (Rollison, Barnett and Stevens, 2002), several studies have observed the positive effectiveness of increased apical preparation on the cleanliness of the apical third (Fornari et al, 2010) in respect to a positive outcome for apical periodontitis healing (Souza et al, 2012), but also a negative effect on the sealing ability (Yared and Bou Dagher, 1994) and postoperative pain (Saini, Sangwan and Sangwan, 2016; de Freitas Portela et al, 2021).

The main drawback of larger apical preparations is the increased risk of creating adverse iatrogenic errors, such as ledges, canal transportations, perforations, zipping, and instrument fractures (Ruddle, 1997; Buchanan, 2000), especially in narrow and curved canals. A literature review, while advocating larger apical sizes, warns against procedural errors and asks to balance the degree of enlargement according to the canal anatomy (Baugh and Wallace, 2005).

To overcome these mishaps, Weine and colleagues (1970) advocated a telescopic preparation with enlargement of the apical part of the root canal three sizes larger than the first file that binds at the working length. This statement was clinically random and debatable.

In 1974, Schilder proposed an innovative manual shaping technique based on each individual canal anatomy. Using recapitulations with reamers and utilising the envelope of motion, it was possible to achieve tapered preparations refined in the apical region by designing a deep shape.

Deep shape was clinically confirmed when any given gauging file was snug at length and each consecutive larger K-file uniformly stepped out of the canal on the order of 0.5 to 1.0mm, depending on the anatomy.

THE ROLE OF DEEP SHAPE IN 3D ENDODONTIC CLEANING

The deep shape allowed excellent mechanical debridement of the apical third simultaneously with improved apical cleaning due to the deep insertion of the irrigating needle and the creation of a reflux space, enhancing the exchange of irrigants, as well as preparing a funnel shape

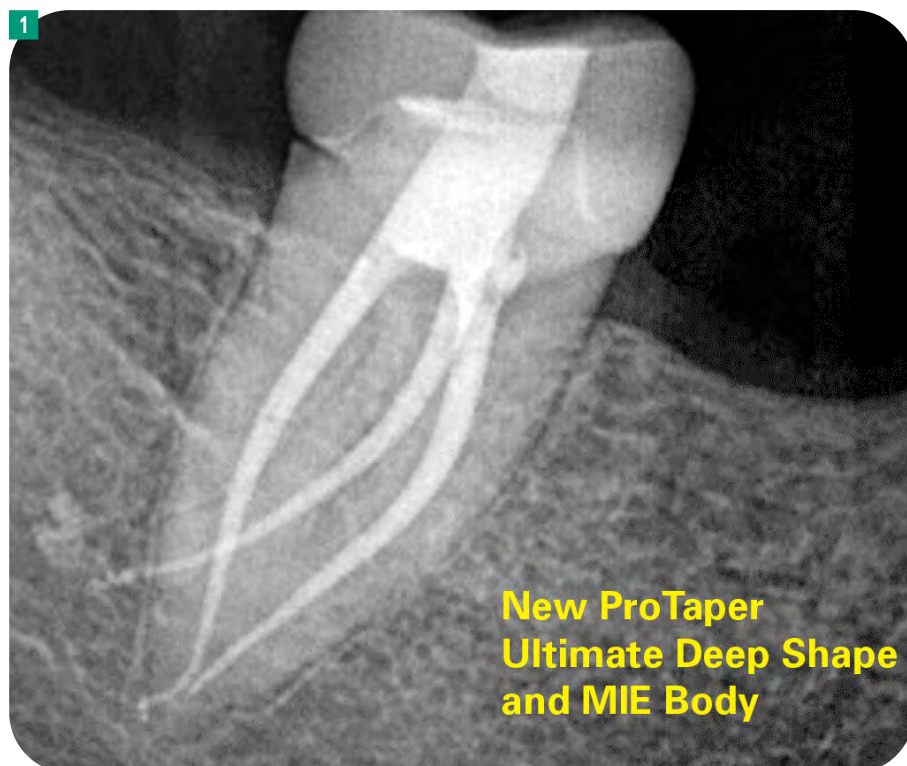


FIGURE 1: Mandibular molar post-treatment image illustrating the preparation outline form of the new Protaper Ultimate shaping system. Noteworthy is the presence of Protaper's legendary 'deep shape', enabling predictable, easy and affordable 3D cleaning and filling combined with a minimally invasive endodontic (MIE) body

enabling confined 3D fillings (Figure 2) (Machtou, 1980).

After shaping in vivo, 60 root canals from anterior and posterior teeth and using a radiopaque solution for irrigation, Yana (1989) demonstrated in his master's thesis that the penetration and exchange of irrigant is complete at the end of the preparation only when the deep shape has been built in the apical region.

In the Toronto study – phase four (de Chevigny et al, 2008), which is the only study comparing the Schilder technique to the standardised technique, the healing rate of the Schilder shaping technique with warm vertical compaction of gutta percha was 10% higher than the standardised technique with lateral condensation: 87% versus 77%. The Schilder technique was considered as a measurably improved outcome predictor.

Coldero and colleagues (2002), when assessing the reduction of intracanal bacteria during root canal preparation with and without apical enlargement, reported: 'It may therefore not be necessary to remove dentine in the apical part of the root canal when a suitable coronal taper is achieved to allow satisfactory irrigation of the root canal system with antimicrobial agents.'

According to Albrecht and colleagues (2004): 'When a 0.10 taper can be produced at the apical extent of the root canal, there is no difference in debris removal between a size #40 and a size #20 preparation.'

Khademi and colleagues (2006) have shown on mesiobuccal canals of extracted mandibular molars that the minimum instrumentation size needed for penetration of irrigants to the apical third of the root canal is a #30 file, preferably with an 0.06 taper.

Caron and colleagues (2010), using the Protaper system for shaping difficult molar canals with different irrigation protocols, discovered that very high levels of root canal system cleanliness could be obtained in the apical third after sonic Endoactivator (Dentsply Sirona) activation and manual dynamic activation.

In a digital subtraction radiographic ex vivo study, it was shown that cleaning and shaping root canals with Protaper instruments improved penetration and exchange of irrigants (Bronnec, Bouillaguet and Machtou, 2010).

In a second study, the same authors identified that only active irrigation allowed complete irrigant penetration and exchange in curved canals after Protaper shaping (Bronnec, Bouillaguet and Machtou, 2010).



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FIGURE 2: This eight-image montage demonstrates the clinical outcome values of the 'deep shape' look in endodontic preparations: radiographic evidence of 3D cleaning and filling. It has been called 'the thrill of the fill'. The defining experiential 'moment' in endodontics is the anxious time when waiting for the fill image to come up on their imaging or radiographic system. When the image appears and the anatomy is visibly filled, there is an immediate sense of joy, satisfaction, and clinical triumph. It is a feeling that brings out the child in us and permits us to be fun and productive endodontic clinicians knowing that we can be confident, consistent, and in control of the patient's endodontic outcome!

For syringe irrigation alone, the level of the needle tip placement in the canal, which depends on the space allowed by the shaping procedure, was the most dominating factor.

Results from a study by Boutsoukis and colleagues (2010) using an unsteady computational fluid dynamic stressed the impact of an increased taper for improving irrigant replacement and wall shear stress apical to the needle tip while reducing the risk for irrigant extrusion. It was demonstrated that a 30/09 tapered preparation with a Protaper F3 was equivalent to a 60/02 preparation.

THE ROLE OF DEEP SHAPE IN 3D ENDODONTIC FILLING

The deep shape is also an essential component for sealing the root canal system after shaping. Proper deep shape provides the resistance form to contain the filling inside the root canal.

In the early 1990s, Yared and Bou Dagher (1994a; 1994b) showed in two studies the benefits of maintaining a small apical size compared to a large one in order to obtain a hermetic seal of the root canal system and avoid extrusion of filling materials.

The deep shape is mandatory for softened gutta percha techniques, such as warm vertical compaction and carrier-based obturation, to allow the capture of apical anatomy, which is an essential prerequisite determinant for predictably successful endodontics (West, 1975).

A micro-computed tomography, studying

the influence of apical taper on the quality of thermoplasticised root canal fillings, found that shaping the apical third (last 3mm) of root canals to an 8% taper is necessary to achieve a better sealing ability and thus long-term success for root canal obturations (Zogheib et al, 2012).

The recent availability of bio silicate sealers has updated the use of the single cone technique. But, as opposed to the old, standardised technique (Ingle, 1961), all current canal preparations are performed with tapered instruments. So, to expect a 3D seal, a perfectly matching gutta percha cone is mandatory.

Germain et al (2018) have assessed the influence of root canal taper on the apical adaptability of three root canal sealers and matching GP cones used in a single cone technique by measuring void's volume. In this study, 6% tapered preparations showed significantly less voids compared with a 4% tapered preparation.

In a confocal microscopic evaluation, Eid et al (2021) assessed the impact of warm vertical compaction (WVC) on the sealing ability of calcium silicate-based sealers in comparison with the single cone technique (SCT). WVC allowed better penetration at 1mm and 5mm into the dentinal tubules than the SCT.

After shaping with Protaper Ultimate, whatever the filling technique used, the triple lock fit of the new Dentsply Sirona GP cones provides a better seal over a wider surface distance of the preparation walls.

In conclusion, available reliable data is poor so far to solve the dilemma between apical size and taper after shaping. There are very few randomised controlled clinical trials, and they assess mainly the effect of increased apical size on the outcome of healing radicular periodontitis (Saini, Sangwan and Sangwan, 2016) and postoperative pain (de Freitas Portela et al, 2021; Silva et al, 2013).

The only CONSORT prospective randomised clinical trial assessing, for the first-time, different preparation sizes combined with different apical tapers on the outcome of primary endodontic treatment was released in September 2021 (Fatima et al, 2021).

Based on a thorough literature review and a stringent protocol, the results of this study showed that the minimum apical preparation required to adequately disinfect the canals was 25/0.06 or 30/0.04, which is in accordance with previous studies (Coldero et al, 2002; Albrecht, Baumgartner and Marshall, 2004; Khademi, Yazdizadeh and Feizianfard, 2006).

DEEP SHAPE SUMMARY

The new Protaper Ultimate shaping system, with a shorter range of instruments, simplifies the shaping procedure and combines a minimally invasive tapered preparation coronally with the predictably successful Protaper deep shape, 3D cleaning, and 3D filling hallmark distinctions.

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This article was originally published in the January/February 2022 issue of Dentistry Today and has been reprinted with permission.

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Charlie's engaging presentation style and many pearls of wisdom about techniques for accessing preparing and operating canals in a systematic way broadened all the skills and clinical confidence.

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AIDING ENDODONTIC TREATMENT

1 Control memory files. By far the most common question I get asked by other dentists is: 'Which file system do you use?'.

However, as I have gained experience, I have found that it's better to think about this question in another way. Single file systems bring wonderful simplicity – but is it better to assess the case in front of you and then decide what is the optimal file sequence and file properties needed to complete this case in a safe and efficient manner?

I do not limit myself to one particular file system, but have spent a lot of time working with different systems to understand their features.

Two properties that are important for me are:

- Cutting efficiency
- Flexibility.

Ironically, these can be diametrically opposed properties, as many of the files that have the best cutting efficiency have poor flexibility – and files that have amazing flexibility have poor cutting efficiency.

The 13/4 VS Flexi (Rogin Dental) glide path file has become my default file for the most difficult cases I treat, and I use it in combination with other files in straightforward cases.

Most procedural errors are completed with the step from size 10 stainless steel (SS) file to size 15, as there is a 50% increase in diameter moving up these sizes.

To minimise the likelihood of errors, I recommend thereafter taking a loose 10 file to length.

The next file to use is 13/4 controlled memory file. This file can be used at 280-350rpm rotation or in a tactile controlled activation technique.

The advantage of using this file is that the controlled memory properties allow excellent flexibility to follow the original anatomy of the canal system. It is a heat-treated controlled memory file with parallelogram cross section and has a constant 0.4 taper.

The small taper means we can conserve precious dentine in the pericervical region, which may assist to reduce the incidence of root fracture.

2 Woodpecker AI endo motor. This endo motor was developed alongside the wonderfully talented, world renowned endodontist Professor Yoshi Terauchi.

The endo motor allows you to optimise your endodontic workflow by being an all-in-one solution when it comes to bypassing ledges, apex locating and fine-tuning flexibility.

The motor is light and cordless, allowing optimal ergonomic working. It has a super mini head on the contra-angle handpiece, which is invaluable in cases with limited access.

The head of the handpiece has 360° rotation and a built-in accurate apex locator.

This, along with the T-mode for bypassing ledges, means that once a file has got past the obstruction it doesn't need to be removed from the canal and can be safely instrumented to length, simultaneously smoothing the ledge as the file moves deeper into the canal system.

T-mode works by watch-winding the file up to the ledge: 90 degree clockwise and 90 degree counterclockwise. Short up and down movements with a precurve file allows the file to climb the ledge and once bypassed the file can be switched to a rotation mode, ensuring efficient shaping and smoothing of the ledge. The motor has a high-performance brushless motor with long service life and wireless charging.

The AI endo motor works with any file system. In my opinion, it is very important to have an open software system where you can change parameters for rotation and reciprocating and use any system you like.

All new users remark at the smooth rotation, low vibration and quiet motor.

The speed ranges up to 2,500rpm with the increased speed very useful in retreatment cases.

All in all, this is a great all-round endo motor and represents excellent value for money. [📺](#)

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WHY USE ADIN TOUAREG S IMPLANTS?

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In addition, the wide thread design of Touareg implants increases the surface area of the implant and allows for more blood to reach the surface of the implant on placement. This has been shown to increase the amount of bone in contact (BIC) with the implant, which increases the stability of the implant offering more chance of long-term success.

The active thread design enables Adin implants to be fully inserted in just a few turns. Also, the implant can be withdrawn and redirected to attain optimal positioning, if required, while still maintaining excellent primary stability. The high primary stability of Adin implants after placement means they are ideal for immediate loading.

Adin offer two types of Touareg implants within their range – Touareg S and Touareg Closefit. Both can be placed at bone level or subcrestal for maximum flexibility.

TOUAREG S IMPLANT BENEFITS

Adin's most popular implants, Touareg S offer customers the opportunity of a simple switch from their existing implant system with no change to their surgical technique. The full range of restorative components for Touareg S implants – from healing abutments, impression transfer copings, through to final restorative abutments – fit all five diameters (3.5, 3.75, 4.2, 5.0 and 6.0mm) of Touareg S implants. Likewise, one implant driver fits all the implant diameters and one restorative driver fits all the restorative components. The 2.42mm diameter standard internal hex connection on the Touareg S implant is a proven and reliably strong connection between implant and abutment.

The SLA (Sandblasted, Large grit, Acid-etched) surface treatment on Touareg S implants has been used for many years. The surface is blasted with aluminium oxide particles and acid etched. This increases the surface area of the implant and therefore allows more possibility of BIC to increase the stability of the implant.

Touareg S implants have built-in platform switching ability, enabling smaller diameter abutments to be placed on larger diameter implants.

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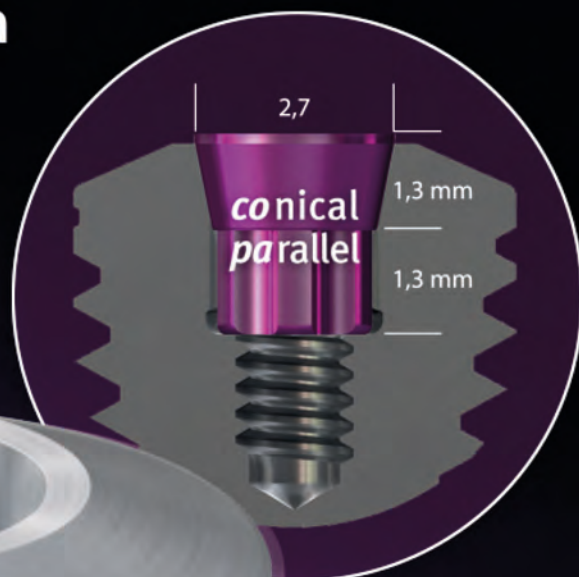
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Key to remedial treatment
is prompt identification of
problems before they escalate,
and systematic analysis of
complications after they occur
– Angela Cowell & Beatriz
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**ANGELA COWELL**

Angela qualified in dentistry from the University of Newcastle-upon-Tyne in 2002 and was awarded the Diploma in Implant Dentistry from the Royal College of Surgeons, Edinburgh in 2021. She works at the Campbell Clinic and is a committee member of the UK and Ireland branch of the Women's Implantology Network (WIN).

**BEATRIZ SANCHEZ-INIGO**

Beatriz qualified in dentistry from Barcelona University in 2008 and gained an MSc in clinical implantology from the University of Central Lancashire (UCLAN) in 2017. She practises exclusively in oral surgery and dental implants. She is an implant mentor, lecturer and manages the content of postgraduate implant teaching courses at the Campbell Academy.

ENHANCED CPD

GDC anticipated outcome: C

CPD hours: one

Topic: Implant dentistry

Educational aims and objectives:

To recognise, manage and, where possible, prevent complications in implant dentistry and communicate these to the patient. This article qualifies for one hour of enhanced CPD; answer the questions on page 110 or scan the QR code.



Dental implant treatment can significantly improve a patient's function, aesthetics and quality of life. However, this treatment is not without complications. This article aims to highlight the most common complications so they can be recognised by all practitioners.

Being aware of complications at an early stage means they can be intercepted and managed as soon as possible – before implant failure. In addition, this article discusses how to prevent complications where possible. As Eleanor Roosevelt said: 'Learn from mistakes of others, you can't live long enough to make them all yourself.'

Even before treatment starts, a patient must understand that complications can occur, despite clinical skills, experience and irrespective of the apparent cost of treatment. Where different clinicians place and restore implants, a clear handover between the implant surgeon and restorative dentist is needed, as well as excellent relationships between clinicians and laboratories.

When complications occur, good patient communication is essential. Explaining the problem and its ramifications clearly and what resolutions may occur is an important responsibility for those undertaking implant dentistry. Asking colleagues and discussing cases are learning opportunities.

Campbell and Hare (2022) explained the importance of audit in the January issue of *Clinical Dentistry*. It is extremely valuable to log your complications to enable reflection, and perhaps

identify patterns that lead to a change in your practice. Having this dataset also helps you accurately explain your success rates to patients.

CLASSIFICATION OF COMPLICATIONS

Arguably, the most comprehensive classification of complications is by the International Team for Implantology (ITI) (Bragger and Heitz-Mayfield, 2015), which divides these into:

- Surgical
- Biological
- Aesthetic
- Hardware.

However, there are other ways of classifying these, as shown in Table 1.

For the purposes of this article, the common implant complications are divided into those occurring early and later in a patient's treatment.

EARLY COMPLICATIONS

Early complications can occur at the time of surgery or in the weeks after this, as well as during the restoration process.

Here, early complications are further divided into 'surgical' and 'restorative' subsets.

SURGICAL COMPLICATIONS**1. Nerve damage and uncontrolled bleeding**

Nerve damage and uncontrolled bleeding are the most significant complications of implant surgery. Thorough digital planning with the use of cone beam computed tomography (CBCT) scans and planning software should mitigate risk to the inferior dental nerve, its branches or any vessels (Figure 1).

Particular attention should be paid to the anterior lingual canals during anterior mandibular implant-placement. If these vessels are breached and bleed this can lead to swelling in the floor of the mouth and airway compromise. This would be a medical emergency requiring urgent hospital treatment.

It is important to explain to patients when you expect full sensation to return following the administration of local anaesthetic. Should the

Classification of complications

Surgical	Restorative
Early	Late
Patient related	Dentist related
Implant components (mechanical)	Prosthetics (technical)

TABLE 1: Classification of complications

Angela Cowell and Beatriz Sanchez-Inigo highlight the most common complications in implant dentistry and how to prevent them where possible

Complications in implant dentistry



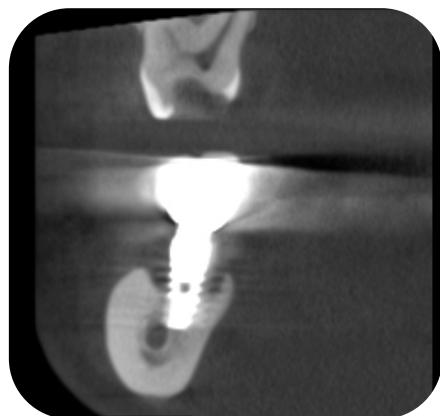


FIGURE 1: Implant placed too close to the inferior dental canal; a suitable safety zone has not been planned



FIGURE 3: Short sutures causing ulceration of soft tissue

patient experience numbness beyond this, they should be instructed to contact the practice immediately. However, as normal postoperative swelling develops, patients can also feel this as a numb sensation and, therefore, it is important to be able to distinguish between the two.

A phone call to patients the day after surgery and access to an out-of-hours service is an important part of postoperative care.

2. Incorrect placement of implant

Implant success is dependent upon accurate implant positioning. Figure 2 shows an implant that was not placed at the correct angulation and later required removal as its restoration failed.

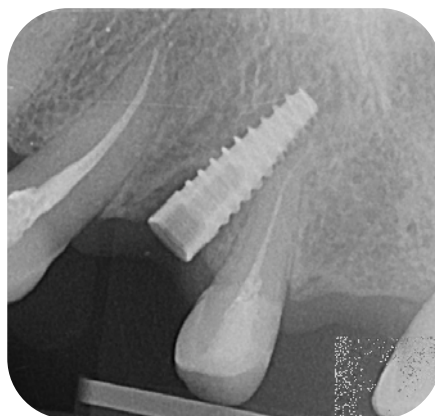


FIGURE 2: Incorrect angulation of implant UL4



FIGURE 4: Poor plaque control

A contributing factor to its failure may have been the patient's limited opening, which then impacted upon the angulation of the handpiece that was possible for preparing the osteotomy.

Care is needed to avoid overpreparation and excessive force in placing an implant. This can lead to overheating of the bone and subsequent failure of the implant to integrate.

In the posterior maxilla, excessive force can result in an implant being displaced into the maxillary sinus.

3. Implant failure

Early implant failure can occur before integration is achieved and patients can present a number of weeks following surgery with an implant that has been completely lost from the site. Usually this is relatively painless (similar to the exfoliation of a deciduous tooth) and soft tissue healing occurs quickly.

At exposure, removal of the closure screw through a reverse torque test serves to check the integration of an implant.

If an implant has failed, pain will occur during the removal of the closure screw and the implant will be seen to rotate.

This can also be the case if the implant fails at subsequent restorative stages.

4. Infection

The authors do not routinely prescribe antibiotics for implant placements, unless bone augmentation is being undertaken, and consider postoperative infections to be a rare occurrence.

5. Soft tissue problems

Pain can result from non-resorbable sutures that are cut too short, as they can be sharp and irritate the adjacent tissues (Figure 3). However, resorbable sutures are not a suitable alternative as they tend to attract plaque.

Incisions should be closed with tension-free suturing, otherwise exposure of the membrane used in bone augmentation can occur and granulation tissue forms. This can lead to failure of the bone material and infection.

RESTORATIVE COMPLICATIONS

1. Problems with temporary restorations

It is essential that a patient's temporary restoration does not impinge on the surgical site, as excessive mucosal pressure can lead to wound breakdown, loss of bone graft material and potentially implant failure.

A patient's denture must be relieved and ideally left out for a few days following surgery.

The authors find patients are very satisfied with Rochette bridges as temporary restorations, although occasionally they can debond.

2. Overgrowth of soft tissue

A minor complication can occur if, after exposing a dental implant and fitting a healing abutment, the surrounding soft tissue grows over the healing abutment before the patient's next appointment for impressions.

This means that local anaesthetic and an incision are required in order to remove the healing abutment, followed by placement of a larger one.

This may result in a delay of subsequent restorative stages as the soft tissue needs to reform around the new healing abutment.

3. Unable to fit restoration

Occasionally, an implant crown cannot be fitted: this can be related to tight interproximal contacts or soft tissue obstructing its seating.

Adjustment of the crown mesially and distally may be needed, or manipulation of the soft tissues.

It is important to take a radiograph of the fitted implant restoration to ensure full seating and to monitor implant bone levels in the future.

LATE COMPLICATIONS

Late complications can occur once an implant prosthesis has been fitted and the patient enters a maintenance phase of treatment.

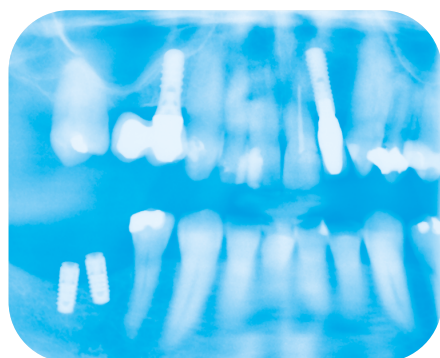


FIGURE 5: Malposition of implants LR6 and LR7, which are convergent and too close together

Initial planning stages play a key role in the prevention of late complications. A treatment plan should be comprehensively designed – for example, considering posterior support for the protection of anterior restorations. This is not always something a patient is interested in, but it is important to be able to stress the relevance of proposed treatment.

Patients need to accept that implant dentistry is not a one-off treatment, and will require long-term follow-up and maintenance.

This needs to be taken into account not only when assessing risk, but also to ensure the patient is informed before treatment starts. This is a key aspect of implant success.

1. Peri-mucositis and peri-implantitis

Peri-implant infections (or peri-implant diseases) occur after inflammatory processes in the peri-implant area.

When there is inflammation of the peri-implant mucosa (bleeding on probing) without loss of supporting bone, it is described as peri-implant mucositis. When, as well as inflammation, there is bone loss, it is described as peri-implantitis. In this scenario, comparison with baseline probing depths aids diagnosis and suppuration may also be present.

Factors that can influence long-term periodontal stability of dental implants include:

- Smoking, poor plaque control (Figure 4)
- Malposition of dental implants (Figure 5)
- Non-cleansable restorations (Figures 6 and 7)
- Medical conditions affecting healing and soft tissue response, such as uncontrolled diabetes and immunocompromise (Figure 8).

Reducing the risk of mucositis and peri-implantitis

Volume 13 of the *ITI Treatment Guide* series discusses management and prevention of peri-implant disease in depth (Heitz-Mayfield and Salvi, 2022).



FIGURE 6: Non-cleansable implant restoration in upper left molar region – the implants were splinted in a single molar-shape restoration but access could not be gained around them

In this article's authors' dental practice, a 10-year implant guarantee is offered, linked to a hygiene maintenance programme. This programme is risk dependent, and patients are seen between one and four times a year, accordingly.

This programme is complemented with a pre-treatment phase with the hygiene team. This includes not only mechanical cleaning and disease control, but also a risk assessment (plaque control, medical conditions, smoking habit), and grading of the complexity of implant treatment. Thorough oral hygiene instruction is given and the maintenance programme explained.

After an implant restoration is fitted, the patient has an appointment with the hygiene team to take baseline probing measurements, and to demonstrate how best to clean their new restoration. Any maintenance programme such as this will reduce the possibility of late complications, by reducing risk factors but also identifying problems at an early stage.

Management of peri-implantitis

Peri-implantitis is a huge topic with many different approaches and characteristics, the full description of which is outside the scope of this article. However, management of peri-implantitis can be considered as non-surgical, resective, reconstructive, or a combined approach.

At the authors' practice, non-surgical management is preferred. In severe cases, the practice protocol of the use of a topical tetracycline paste (250mg tetracycline tablets crushed with 5ml of sterile saline) yields good results.

2. Occlusal problems

Implant failure can occur where an implant loses integration due to occlusal overload (Sheridan et al, 2016). In these cases, the bone loss is not progressive as in peri-implantitis, and there is



FIGURE 7: Photo of this restoration showing lack of a cleansable space

usually no infection around the failing implant.

The risk of occlusal overload can be reduced with monitoring of the occlusion over time and careful planning, such as considering appropriate posterior support for anterior restorations.

A loose screw is an event that can be reported frequently, but is not necessarily a serious complication. However, this may be a warning of potential occlusal disharmony and so provides a timely opportunity to review and adjust occlusal factors.

Implant fracture (Figures 9 and 10) is a relatively rare complication in comparison.

3. Fractured components

Different components of an implant-retained reconstruction can fracture. Being familiar with different prosthetic approaches and brands is therefore important, as these complications can be challenging, especially if they are not your own restorations.

Fracture-related problems can be related to planning stages involving a mis-selection of components. Poorly researched brands, cloned components, or misuse of parts can contribute to late complications.

SERVICE EVALUATION OF IMPLANT-RELATED COMPLICATIONS

All the terms described so far in this article are useful for retrospective classification of complications, but it is through gathering data from your own practice that you can begin to proactively recognise potential areas for concern and consider any preventive action.

In the last year, more than 500 implants were placed at the authors' practice. They also accepted many referrals for problems with existing implants that had been placed outside the clinic, thus expanding the broad range of issues to contend with.

A service evaluation to monitor implant-related complications was set up, considering



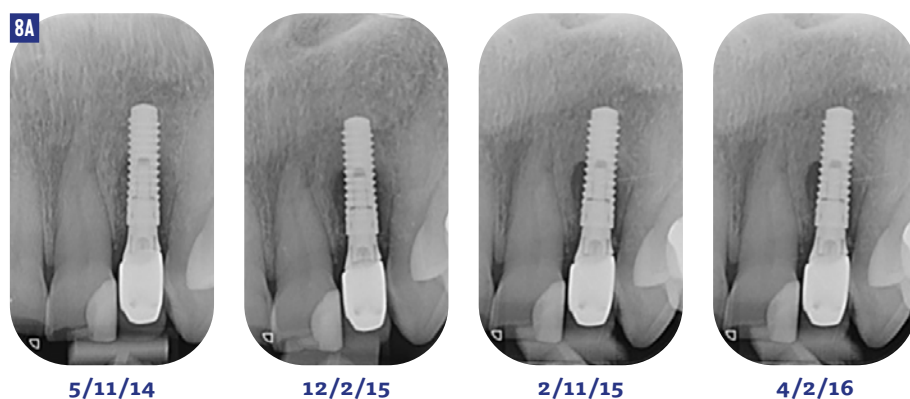


FIGURE 8A: Radiographs showing progressive bone loss around UL1 implant. The patient had diabetes



FIGURE 8B: Probing depths were taken (which were over 10mm) for clinical control and assessment



FIGURE 8C: A surgical approach was required to treat the area



FIGURE 9: A crown with part of a fractured bone level implant attached

any unplanned attendance or episode of care as a complication. From this data collection, the most common implant-related complications were recently reported (with most frequent first) as:

1. Suture related
2. Loose/lost implant bridge
3. Pain
4. Loose/lost temporary bridge
5. Loose/lost crown
6. Mucositis
7. Failed implant
8. Chipped ceramic.

As a result of this evaluation, it is emphasised to patients in their postoperative instructions that their sutures will feel long, however if they are cut too short, they will be sharp.

Previously, loose/lost temporary bridge was the most common presenting complication. The practice undertook changes in the design of bridge wings and cement and since this change there has been a decrease in the number of these problems.

This does, however, put some perspective into implant-related complications: the majority are minor issues that, while we would seek to avoid altogether, are on the whole relatively straightforward to correct.

CONCLUSION

Dental implants can significantly improve a patient's function, aesthetics and quality of life. However, this is an elective and complex dental treatment that will always carry with it a risk of complications.

Good assessment processes will mitigate these as much as possible, especially restoratively driven planning and preoperative hygiene appointments, as well as long term maintenance.

Communication with the patient is essential. While patients should consent at the start of treatment that complications can occur, an effective system for handling unforeseen circumstances will help maintain a good relationship with the patient while complications are managed.



FIGURE 10: Remaining portion of implant from Figure 9 still in situ

Key to remedial treatment is prompt identification of problems before they escalate, and systematic analysis of complications after they occur. This may involve providing explanations to the patient, follow-up appointments, evaluating the root cause of the problem, reflection, and discussion with colleagues. [10](#)

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Rehabilitation of atrophic maxilla: clinical case

Eduardo Anitua rehabilitates an extremely complex case with dental implants in a predictable manner with a five-year follow-up

The loss of teeth leads to a resorption of the alveolar process that is conditioned to the existence of teeth. This resorption process can be more or less rapid, depending on different factors, including: the time since extractions, the difficulty of exodontia, the presence of previous periodontal disease or persistent infections, as well as traumatic accidents where there has been dental avulsion (Bodic et al, 2005).

This resorption is different from one individual to another, even though the causes of tooth loss have been similar and also different within the same

individual in the same bone area. We can find patterns with vertical, horizontal or mixed atrophies in the same patient that require different treatments for their rehabilitation (Manson, 1976; Felton, 2009; Morand and Irinakis, 2007; Elgali et al, 2017).

Achieving sufficient alveolar bone in width and height for posterior rehabilitation with implants in areas where this bone has been lost is a challenge faced in extreme cases. For this purpose, we have different regeneration techniques available, including bone block grafting, guided bone regeneration and expansion or splitting, among others (Elgali et al,

2017; Benic and Hämmerle, 2014; Jepsen et al, 2019).

In cases where atrophy is severe but there is a small amount of bone volume remaining, other options include the use of narrow implants for horizontal atrophy, short implants for vertical atrophy and a combination of short and narrow implants for mixed atrophy (Klein, Schiegnitz and Al-Nawas, 2014; Anitua et al, 2020; Alkhraisat, 2016; Anitua et al, 2010; Anitua and Alkhraisat, 2019a; Anitua and Alkhraisat, 2019b; Anitua and Alkhraisat, 2019c; Anitua et al, 2014; Monje et al, 2013; Maló et al, 2017).

In cases where there are combined and isolated atrophies in different areas of the same maxilla or mandible, we can combine all these techniques (regenerative approach and implants adapted to the residual bone volume) to achieve an effective treatment.

In the following clinical case, we present a situation of this type, where there are areas with different atrophies that require combined approaches and different surgical techniques. In all of them we are seeking the most conservative and predictable approach to achieve the resolution and rehabilitation of the case by means of dental implants.

CLINICAL CASE

A 59-year-old female patient presented at the practice requesting rehabilitative treatment with dental implants. She had had partial removable prostheses for some time, but they no longer met the



EDUARDO ANITUA

DDS MD PHD

Eduardo is in private practice at Eduardo Anitua Clinic in Spain. He is also the director of the University Institute of Regenerative Medicine and Oral Implantology of the University of the Basque Country, and scientific director of BTI Biotechnology Institute. He is the president of the Eduardo Anitua Foundation for Biomedical Research.



FIGURES 1, 2, 3 and 4: Intraoral images of the patient with and without her removable prosthesis. We can observe the poor condition of the removable prosthesis as well as the decrease in the vertical dimension of the patient, which is more evident in the photographs where the prosthesis has been removed





FIGURE 5: Initial panoramic X-ray, in which we can see the three remaining teeth of the upper arch that will serve as support for the long-term provisionals that we are going to build on the tooth to recover the aesthetics and vertical dimension

functionality and aesthetics that she is looking for.

In the intraoral images with and without prosthesis, we can observe the evident wear and

the poor aesthetic situation of the prosthesis, as well as a reduced interocclusal space without the prosthesis, due to a collapse of the vertical dimension (Figures 1 to 4).

The initial radiograph highlighted the poor prognosis of restorative treatments in some of the remaining teeth, such as LL4 and UR7, as well as extrusion of the molar in the first quadrant (Figure 5).

After seeing this image, it was decided to make a resin provisional on tooth, with a fiberglass reinforced structure for the upper arch. The patient's remaining teeth would serve as support for the provisional rehabilitation that would be in place during the implant rehabilitation.

In this way, we achieve two objectives:

1. Maintain the patient with fixed teeth at all times
2. Recover the lost vertical dimension and to be able to work on the changes in dental height that affect the masticatory musculature and temporomandibular joint progressively (Figures 6 and 7).

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FIGURES 6 and 7: Provisional prosthesis that recover the vertical dimension and stabilise the occlusion while providing a more comfortable and aesthetic prosthesis for the patient

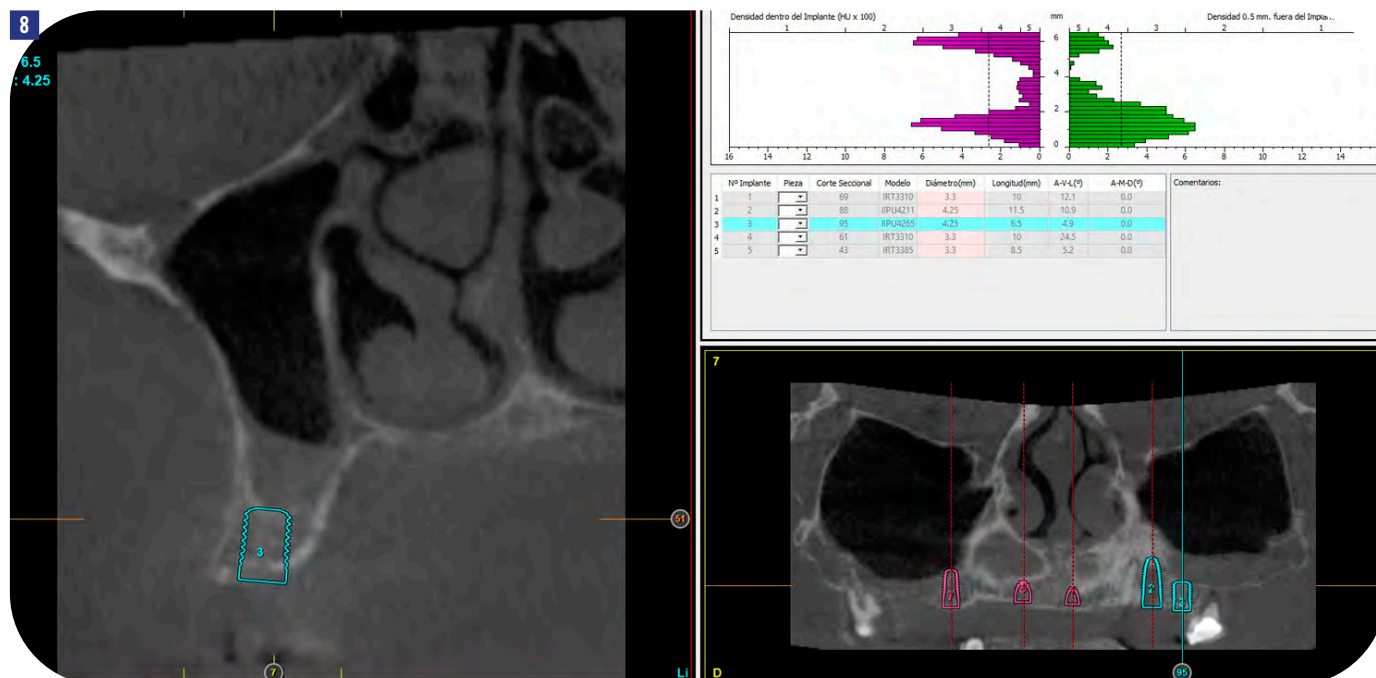


FIGURE 8: Image of the second quadrant with the planning of direct insertion extra-short implant

we have recovered the lost vertical dimension, we perform a dental CBCT to plan the surgical approach. In the analysis of the upper jaw, we found different areas with different degrees of atrophy. The posterior maxillary sectors present atrophy in height, but the second quadrant can be rehabilitated by means of short and extra-short direct insertion implants (Figure 8).

The first quadrant, however, requires sinus elevation, as it has a residual bone volume of 2mm in height. The anterior maxillary area presents a resorption in width that makes us plan the insertion of narrow platform implants in this area (Figures 9 and 10).

In the area corresponding to the right upper canine, we find a very severe atrophy in width

(2mm width of the ridge) so we plan a block graft, which will be obtained from the mandibular ramus (Figures 11 and 12).

Finally, in the right premolars area, we found an area of horizontal resorption, but with both cortices preserved and an interposed cancellous bone that gives us the possibility of performing a split technique.

Due to the low bone volume, we opted for a two-stage split technique with a transitional implant, a technique described by our study group 10 years ago (Anitua, Begoña and Orive, 2012).

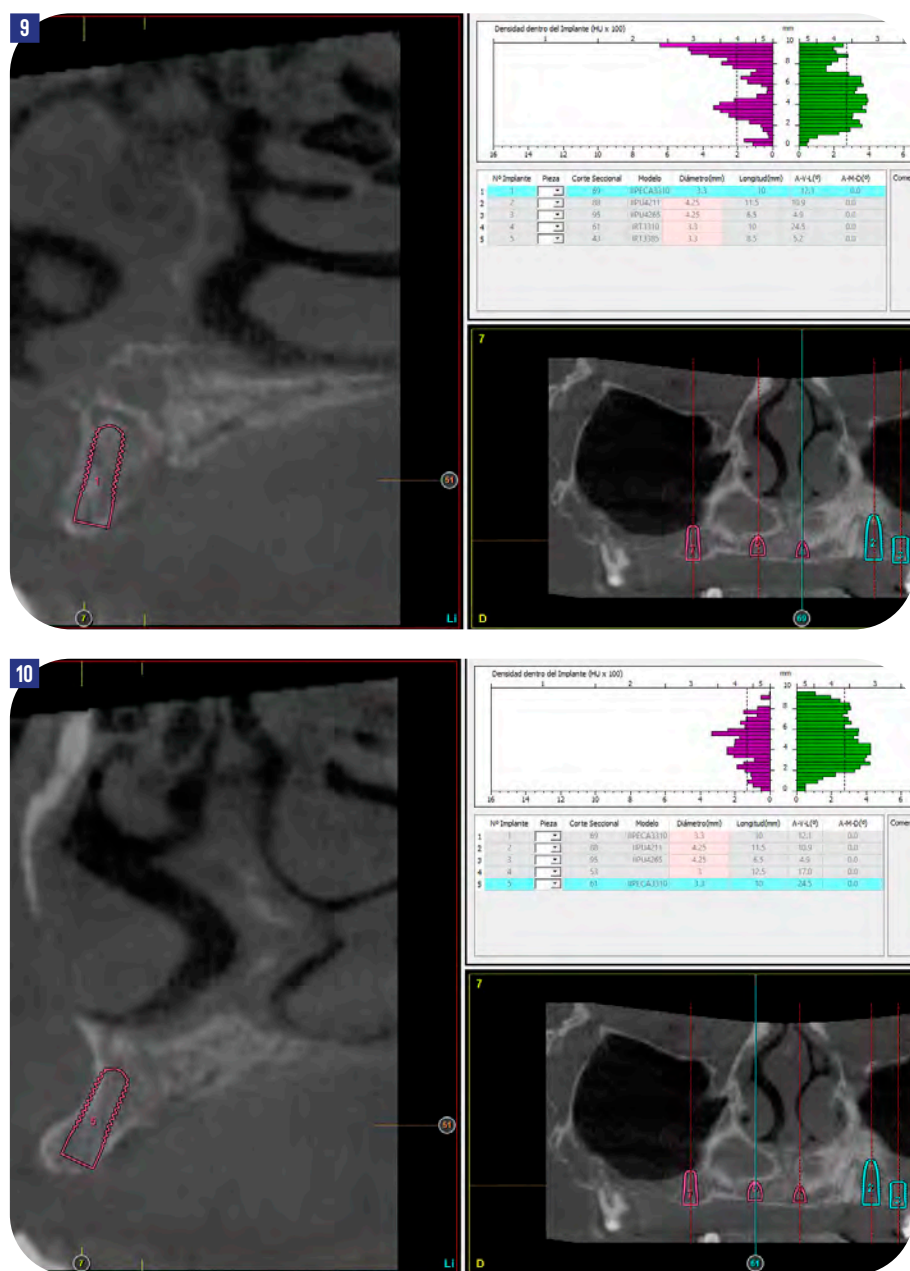
This technique allows us to recover the lost width by means of an osteotomy in which the space with the transitional implant is maintained

and subsequently replaced by a definitive implant that we can insert with a better axis for future rehabilitation (Figures 13 and 14).

In the mandible, short and extra-short implants will be inserted in the edentulous posterior sections at the same time as the mandibular graft is harvested from the mandibular ramus.

Surgical approach

Once the entire case was planned, we proceeded to the surgical approach. Here we performed all the techniques described, with block grafting in the premaxilla area using as donor bone the sinus lift window by lateral approach and a mandibular bone block graft.



FIGURES 9 and 10: Planning images of the premaxilla area where the insertion of small diameter implants is required due to the low bone volume in width of the area

In both cases, the cortex of the block graft is combined with a mixture of particulate bone graft obtained from the biological drilling of other areas, according to the technique described by Khoury (2007).

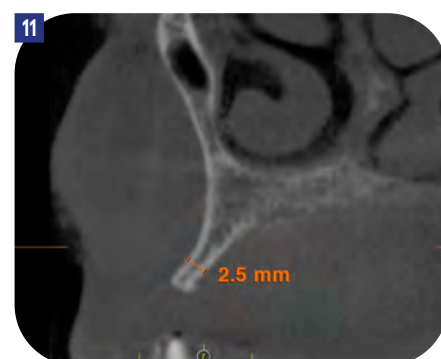
The split technique is performed in two stages – with transitional implant insertion and elevation of the right sinus performed at the same time as direct insertion of the implant in position.

Once the surgery is completed, the entire area is covered with autologous fibrin membranes, retracted, made with Endoret PRGF (BTI

Biotechnology Institute) fraction 2, activated, and retracted and sutured with the lowest possible pressure (Figures 15 to 20).

The lower implants are inserted in this same surgery and, when they present a good insertion torque (all above 20Ncm), immediate loading is performed using articulated bars and screwed resin prostheses with transepithelials.

After five months, we proceed to the re-entry of the surgery to remove the osteosynthesis material and perform the insertion of the implant in the area of the transitional implant.



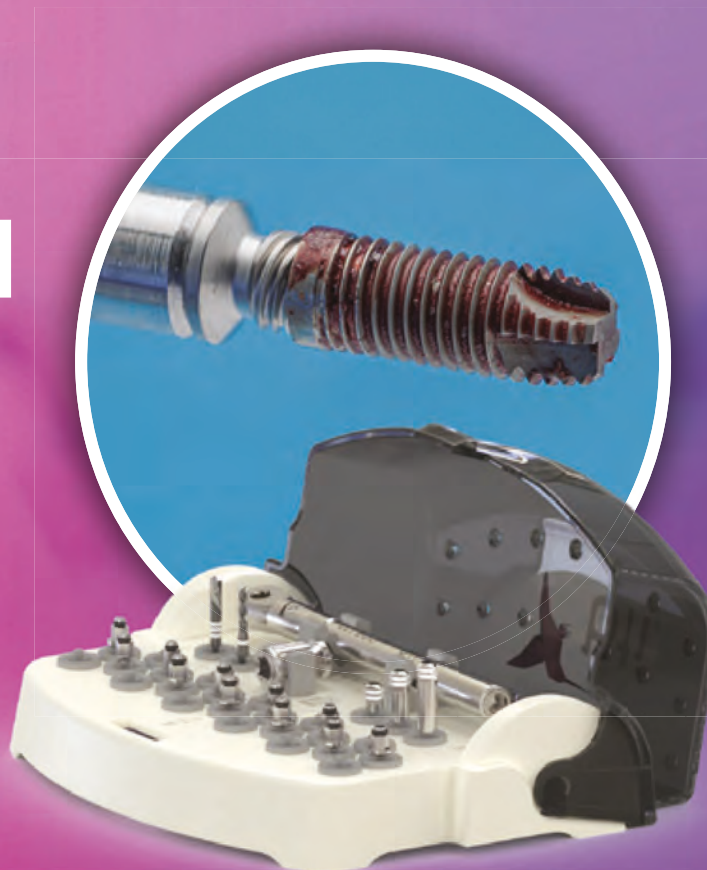
FIGURES 11 and 12: Planning area of the right upper canine, where it is necessary to place a block graft



FIGURES 13 and 14: Transitional implant planning

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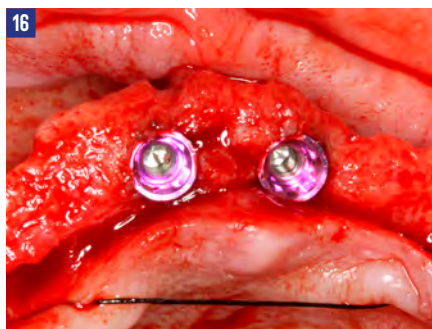
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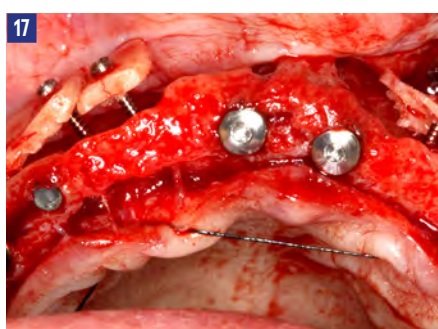


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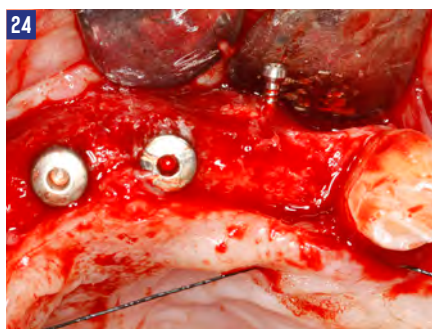
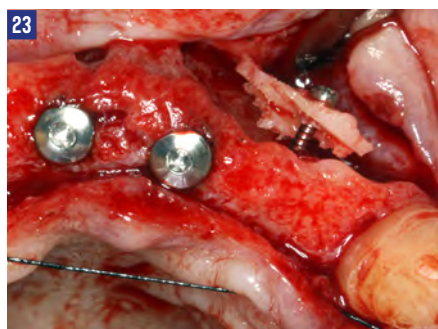
FIGURES 15 and 16: Insertion of narrow platform implants in the anterior maxillary area and split with transitional implants in the right canine-premolar area



FIGURES 17 and 18: Placement of bone block grafts with filling of the gap between the graft and the receptor bone with Endoret (PRGF) and autologous bone obtained from the drilling



FIGURES 21 and 22: State of the soft tissues before opening, where the osteosynthesis screws and regeneration achieved in the area of maximum horizontal atrophy can be seen



FIGURES 23 and 24: In the second quadrant where the maxillary sinus cap was used as a block graft, the result obtained is also very favourable, with a notable increase in the width of the initial ridge, as can be seen in the before and after comparative images



FIGURE 19: Autologous fibrin membranes placed covering the entire surgical site prior to soft tissue closure



FIGURE 20: Final radiograph after the different surgeries performed, including the mandibular implants in which immediate loading is performed

The aspect of the soft tissues before the approach is good and when the opening is performed, we find a ridge that has doubled and, in some cases, tripled the initial width (Figures 21 to 24).

At this stage, the upper left canine, as well as the other two remaining teeth that supported the provisional, are extracted and the new implant is inserted in the area of the sinus elevation.

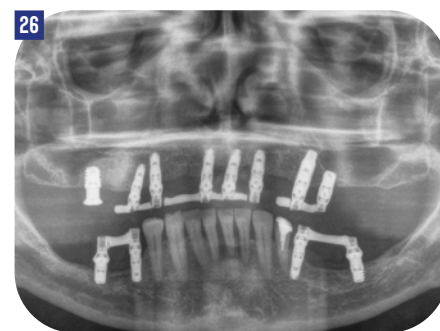
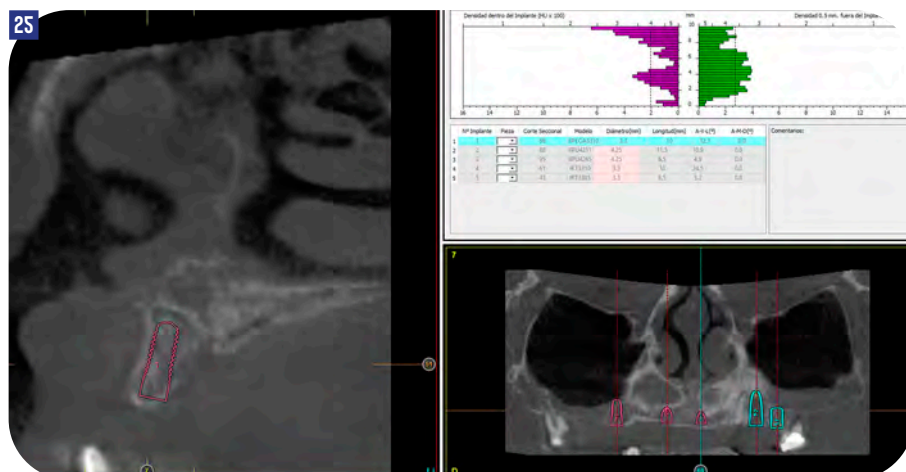
Once the surgery is finished, a progressive load prosthesis is formed by using the articulated bars that allow us to dispense with the teeth that we used as pillars for our provisional (Figures 25 and 26).

Six months later, the fabrication of the definitive prosthesis is started, now including all the upper implants.

For this purpose, CAD/CAM structures are generated for both the lower bridges and the upper arch, which will later give rise to metal-ceramic bridges for the mandible and a complete ceramic prosthesis divided into three sectors, all screwed by means of intermediate or transepithelial elements (Figures 27 to 34).

In addition, the stable maintenance of the rehabilitation during the six years of follow-up of the patient proves the effectiveness of the techniques used (Figure 35).





FIGURES 25 and 26: Planning of the area corresponding to the implant in the first quadrant after sinus lift and progressive loading prosthesis after extraction of the abutment teeth

DISCUSSION

Combining different surgical techniques for maxillary and mandibular rehabilitation with extreme resorption is quite common nowadays. Each of the techniques that can be used in the

different areas, depending on the needs of each specific area, is an advantage, but the surgeon must have experience in all of them and select the one that best suits each patient in each case (Gallucci et al, 2016; Urban et al, 2017; Corbella,

Taschieri and Del Fabbro, 2015; Schwartz-Arad, 2017).

Combining the different modalities of bone regeneration with short or narrow implants that do not require volume augmentation to be

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Day 1 Lectures

- Surgical anatomy with emphasis on advanced augmentation procedures
- Sinus floor elevation and augmentation procedures
- Sinus pathology, recognition and management
- GBR procedures

Day 2 and 3 Hands-on Workshops on Cadavers

- Anatomy review
- Avoiding complications
- Sinus floor elevation procedures:
 - Crestal approach - conventional and newer atraumatic techniques
 - Lateral wall approach sinus floor elevation and augmentation
 - Sinus anatomy including the medial wall in relation to ENT procedures

Course Summary

Date: 24th November - 26th November 2022

Start Time: 09:00

Finish Time: 17:00

CPD Hours: 21

Location: West Midlands Surgical Training Centre, at the University Hospitals Coventry and Warwickshire NHS Trust, Clifford Rd, Coventry, CV2 2DX

Fee: £3,250 Plus VAT

Course Speakers:



Dr Fadi Barrak Course Director

BDS MBBS FDSRCS (Eng), DiplImpDent RCS (Ed), FHEA Maida Vale, London



Professor StJohn Crean

BDS MBBS FDSRCS FFGDP(UK) FDSRCS (Glas) FRCS FRCS(OMFS) PhD PGCMed Ed (Camb) LLM (Edin) FHEA Pro Vice Chancellor (Research, Innovation and Enterprise) Professor of Medicine in Dentistry Hon Consultant Oral and Maxillofacial Surgeon

- Block grafting
 - Soft tissue grafting procedures
 - Evidence based treatment planning
 - Prevention and management of complications
 - Bone ring technique
-
- Block grafting techniques:
 - Harvesting from the chin and ramus
 - Recipient site preparation and graft fixation
 - Flap design and management
 - Soft tissue grafting procedures:
 - Free and pedicle flaps
 - Alternatives to autogenous flaps
 - Management of complications



FIGURES 29 and 30: Finished prosthesis in situ. Aesthetics and function have been recovered as we can see in the intraoral images and the aesthetic profile in a closer view



FIGURES 31 and 32: If we compare the before and after of the patient, we can observe the aesthetic and vertical dimension changes suffered during the whole process

placed also makes the decision tree available for the most complicated cases more versatile.

The long-term stability of all the techniques shown in the present clinical case – short implants, bone block grafts, narrow implants, ridge expansion – have been documented in different studies and have success rates for the implants concerned of between 90 and 100%, according to the series consulted (Jepsen et al, 2019; Anitua et al, 2020; Alkhraisat, 2016; Anitua et al, 2010; Anitua and Alkhraisat, 2019a; Anitua and Alkhraisat, 2019b; Anitua and Alkhraisat, 2019c; Anitua et al, 2014; Monje et al, 2013; Maló et al, 2017; Anitua, Begoña and Orive, 2012).

In our case, the use of all the techniques in conjunction has made it possible to rehabilitate an extremely complex case with dental implants

in a predictable manner with a five-year follow-up.

We should never lose sight of the fact that each case should be individualised in terms of the techniques to be used and the areas to be treated, since in the same patient we can find different clinical situations that require different approaches.

CONCLUSION

From the point of view of atrophy, the most complex cases should be approached with different surgical techniques that are adapted to the specific circumstances of each anatomical location to be treated and we must be able to select the most appropriate technique for each area. [CQ](#)

PRODUCTS USED

Endoret PRGF BTI



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FIGURES 33 and 34: Initial and final X-ray, comparing the initial situation and the one achieved after the rehabilitation treatment



FIGURE 35: Five-year follow-up. Here we can see the stability of the treatment performed, which remains stable over time

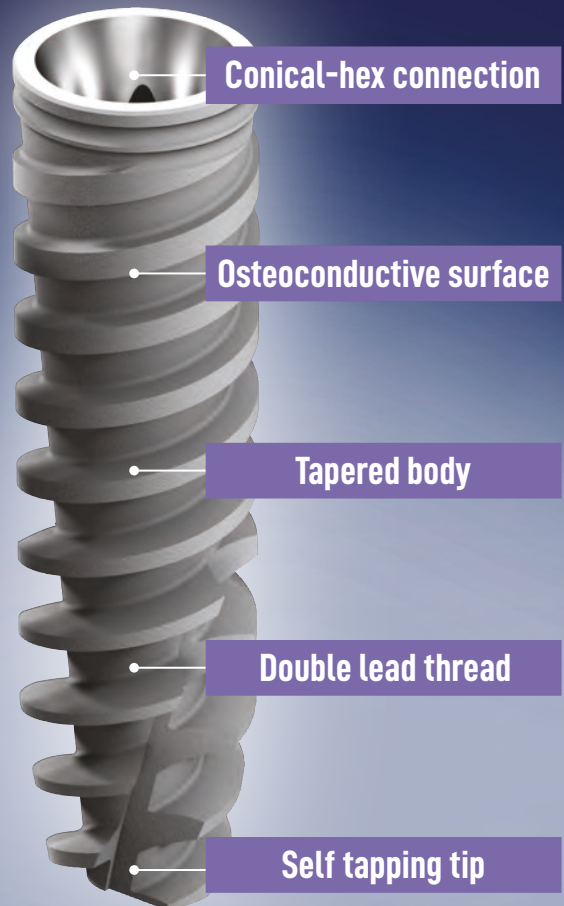
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LABORATORY

PETER ANTOSCH & CARSTEN HÖRR

Fabrication and cementation of monolithic crowns

78



Utilising CAD/CAM software, including its virtual articulator, allowed us to fabricate full mouth crowns with guaranteed success
– Peter Antosch & Carsten Hörr, p78

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MSC MSC
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ENHANCED CPD

GDC anticipated outcome: C

CPD hours: one

Topic: CAD/CAM

Educational aims and objectives:

To discuss fabrication and cementation of monolithic crowns. This article qualifies for one hour of enhanced CPD; answer the questions on page 110 or scan the QR code.



Who has not encountered the problem: crowns are checked on the articulator and all the occlusal contacts are evenly distributed and all excursions such as laterotrusion, protrusion and the retrusion were balanced, yet everything was different in the patient's mouth to the point where crowns had to be remade?

This occurrence is very frustrating for the patient, the dentist and the dental technician. It is also harmful to the dental practice or laboratory's reputation since the patient's expectations of a finished and cemented case without problems were not met.

Well-executed teamwork leaves a positive impression with the patient who trusts an expert group that cares about his/her ideas and expectations.

Thanks to CAD/CAM technology, one can now make a prosthesis without having to perform an occlusal adjustment.

On a daily basis, we encounter patients who are motivated from an aesthetic point of view with high demands that motivates us to fabricate complication-free prostheses that last a lifetime.

Furthermore, the overall aesthetic result, timeframe and cost should be agreed upon among all parties involved.

INITIAL SITUATION

Our observations included:

- A reduced vertical dimension (VDO)
- Short teeth
- Black triangles
- Severe gingival recession.

This matched the patient's desire to improve his aesthetics (Figures 1a to 1c).

Because of the patient's longstanding bruxism condition, his vertical dimension had decreased

approximately 3mm or 4mm. Moreover, there was a widespread appearance of dark cementum when the patient smiled.

Impressions were taken along with a facebow registration and a centric relation bite fork registration. The models were poured and then mounted on an articulator.

With the use of composite, it was possible to



FIGURE 1A: Mandibular teeth



FIGURE 1B: Maxillary teeth



FIGURE 1C: Close-up frontal view

Peter Antosch and **Carsten Hörr** present a bruxism case whereby full mouth crowns were produced using CAD/CAM and then cemented

Fabrication and cementation of monolithic crowns



FIGURE 2A: Maxillary model of the prepared teeth



FIGURE 2B: Initial model, impression and prepared model

restore the patient's lost VDO to an additional 2mm.

The temporomandibular joint (TMJ) was evaluated after two months without any sign of a disorder.

All teeth were prepared for full coverage crowns and then PVS impressions were taken utilising retraction cord. The models were poured (Figures 2a and 2b).

PROTOTYPE DESIGN

The scanned models were evaluated on a virtual articulator. Temporary Ceramill PMMA (Amann Girrbach) transparent acrylic crowns were CAD planned (Figures 3a to 3d).

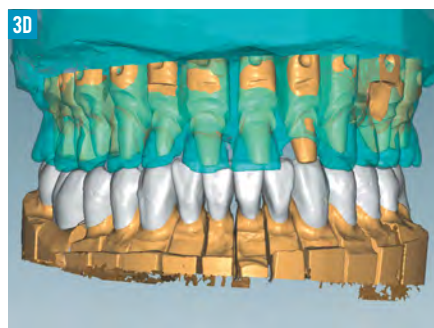
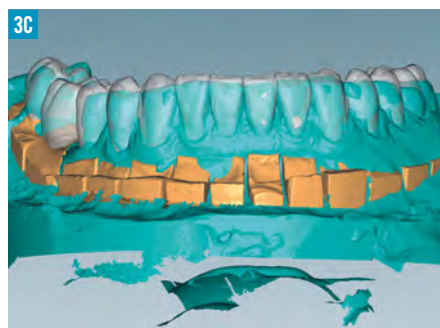
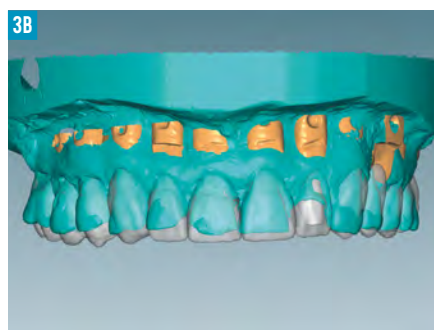
The goal of the temporary crowns is to have the patient get used to the new:

- VDO/TMJ positions
- Tooth shade
- Curve of Spee
- Excursive movements.

Patient data, including condylar movements, were recorded by the software. Using the initial situation software's customised incisal guide unit, the incisal guide pin was adjusted on the splitex plate to the desired cuspal inclinations on the virtual temporary crowns (Figure 4).

All patient parameters, including condylar inclination, were transferred to the Ceramill Artex articulator and the lateral and protrusive

Patient data, including condylar movements, were recorded by the software



FIGURES 3A, 3B, 3C and 3D: Digital study models with virtual crowns raising the VDO

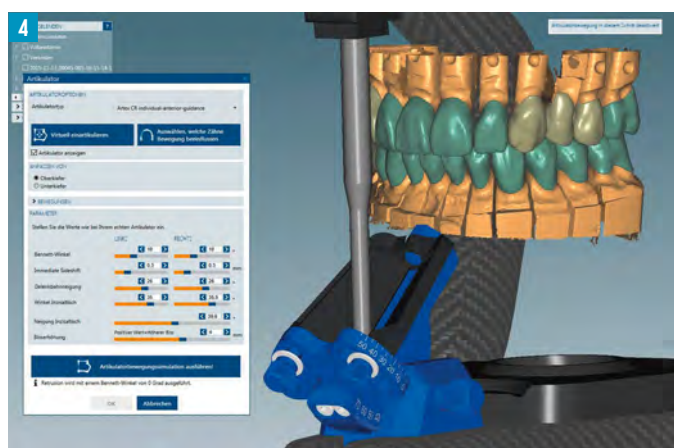


FIGURE 4: Virtual articulator with customised incisal guide unit



FIGURE 5: 'Ignore the anterior teeth' mode on the virtual articulator

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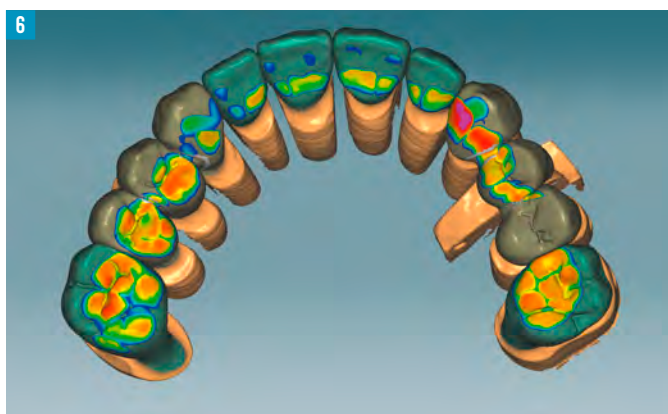


FIGURE 6: Functional occlusion assessment – maxillary teeth

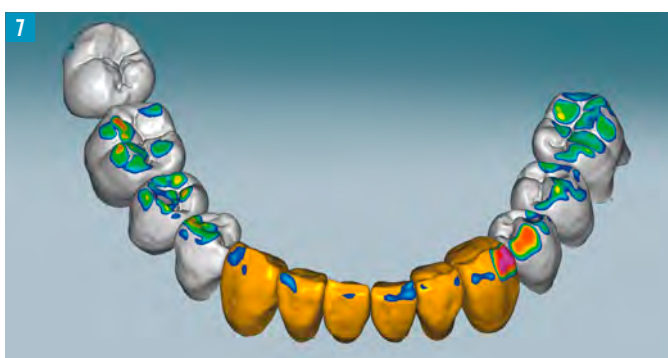


FIGURE 7: Functional occlusion assessment – mandibular teeth



FIGURE 8: Functional occlusion assessment – maxillary posteriors

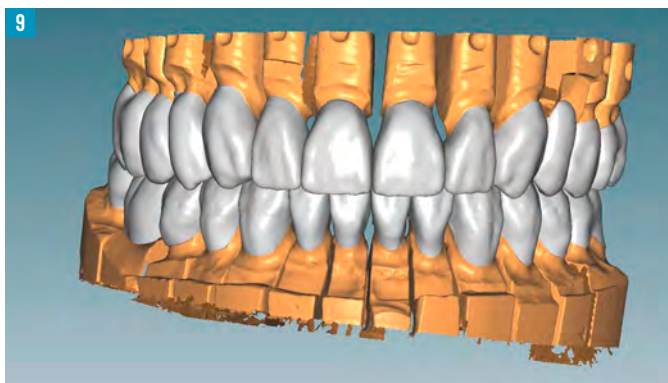


FIGURE 9: CAD protocols



FIGURE 10: Temporary crowns inserted



FIGURE 11: Protrusive evaluation

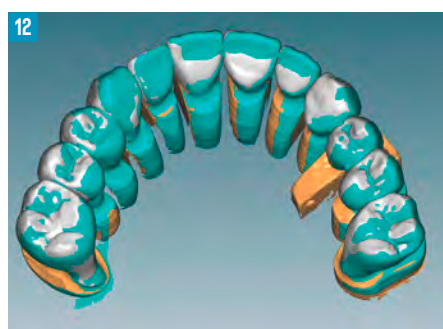


FIGURE 12: Temporary crown adjustments in white

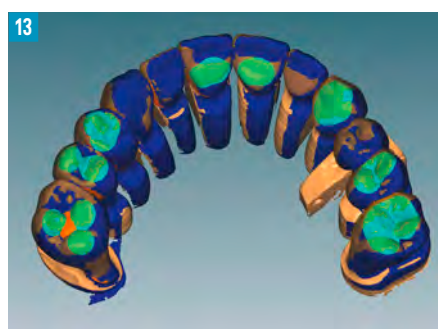


FIGURE 13: Applying the Wizard function to the study model

excursions were established while having no contact with the anterior teeth (Figures 5 to 8).

The virtual temporary crowns were 3D printed and then temporarily cemented. This test phase with temporary crowns is a mandatory step because after the patient evaluated the temporary crowns for several weeks, corrections were made with the input of the patient, thus reducing the risk of errors in the subsequent final crowns.

MONOLITHIC ZIRCONIA CROWNS

Since the patient was a bruxer, we decided to plan for monolithic zirconia crowns, a material that reduces the incidence of chipping.

Given that there was no need to mask any dark colours, we decided to utilise the polychromatic,

super-high translucent, high flexural strength Ceramill Zolid FX monolithic zirconia blanks (Amann Girrbach).

The previously adjusted temporary crowns were removed and transported to the laboratory where we removed the temporary cement and scanned them into our CAD database like we would wax-ups of crowns (Figure 9).

We proceeded to rename our STL file .wax-upa.situ following the scanning of the adjusted temporary crowns. The temporary crowns were recemented intraorally (Figures 10 and 11).

CAD DESIGN OF THE FINAL CROWNS

Using the CAD software (Figure 12), we were able to round off and refine the areas on the temporary crowns that had been ground and

Since the patient was a bruxer, we decided to plan for monolithic zirconia crowns, a material that reduces the incidence of chipping

modified intraorally, leaving the remaining areas unchanged.

Figure 13 shows the areas that were adjusted intraorally in green and the remaining unchanged areas in blue.

The plan was to fabricate Ceramill Zolid FX crowns on the maxillary teeth first, so that subsequent corrections on the lower temporary crowns would mean that fewer corrections would be necessary for the final lower crowns.

Canine guidance with a light group function was created on the Ceramill Mind Wizard.

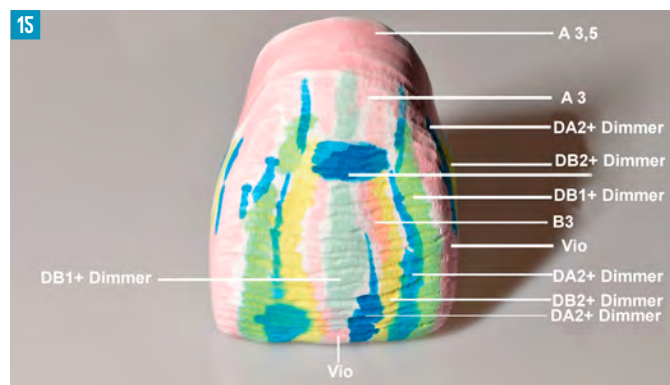
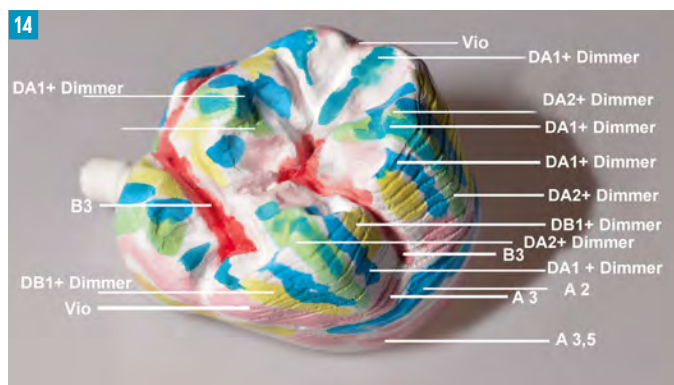
MILLING, COLOURING, SINTERING AND LAYERING

The milled Ceramill Zolid FX (super-high translucent) monolithic zirconia maxillary crowns were polished and then individually coloured with brushed-on Ceramill liquid colour before sintering (as opposed to lithium disilicate, which cannot be coloured before sintering).

The advantage of this is that it produces a similar chroma to that of natural teeth.

The colouring liquids were available in all Vita classical shades and were applied in an alternating fashion.

Liquid colours Dentin A1 + Dimmer, Dentin A2 + Dimmer, Dentin B1 + Dimmer (30% to 70%) and Violet were applied in a strategic way with



FIGURES 14 and 15: Colour-scheme with Ceramill Liquid Eye



FIGURE 16: The crowns before sintering

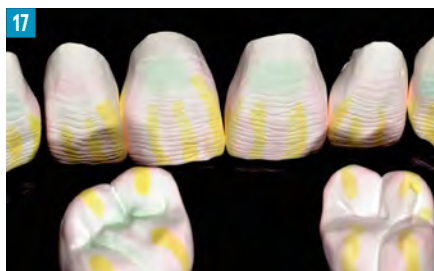


FIGURE 17: The surface texture before sintering



FIGURE 18: Post-sintering surface texture

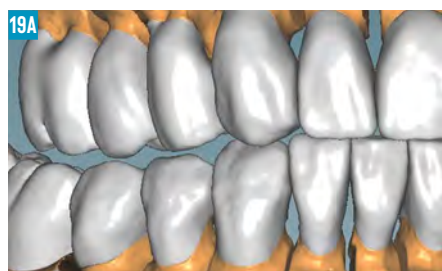


FIGURE 19A: CAD software's left-side view of the final crowns

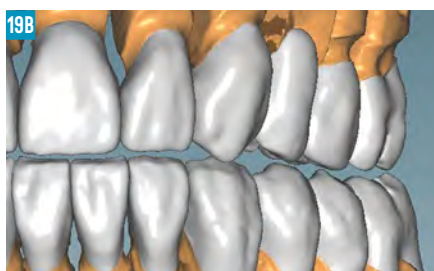


FIGURE 19B: CAD software's right-side view of the final crowns



FIGURE 20A: Left excursion



FIGURE 20B: Right excursion



FIGURE 21: Protrusion



FIGURE 22: A happy patient



FIGURE 23: View in occlusion



FIGURE 24: Three weeks after cementing the crowns

dentine colours B3 and A3.5 being used in the fissure and marginal areas (Figures 14 and 15).

The crowns were immersed for 10 to 15 seconds in the dentine-coloured Ceramill Dimmer liquid. Depth effect, due to the transparency effect of the Ceramill liquids, was achieved using alternating NB/C/D liquids, brown/orange liquids for fissures and interdental regions, grey/blue shade modifier liquids, and Ceramill Liquid Eye.

FINISHING

Transparent lithium silicate Cerafusion (Komet) was sprayed onto the final crowns, followed by glaze firing at 920°C.

Due to the superficial smoothness obtained from glazing, the abrasiveness of the monolithic zirconia crowns towards their antagonist teeth is reduced to a minimum.

The same protocol used to manufacture the final maxillary crowns was used to produce the final mandibular crowns.

CONCLUSION

The decision concerning the most suitable crown material should always account for safety, longevity and aesthetics. Therefore, in bruxism cases, monolithic zirconia crowns should be fabricated due to their fracture strength, thus avoiding the incidence of chipping, while still achieving an aesthetic result.

Utilising CAD/CAM software, including its virtual articulator, allowed us to fabricate full mouth crowns with guaranteed success.

An advantage of monolithic zirconia crowns is that they are fabricated without porosity and are homogeneous compared to other ceramics.

In addition, monolithic zirconia crowns do not exhibit roughness if glazed properly, and therefore end up being kind to their antagonist teeth (Figures 16 to 24). **CD**

PRODUCTS USED

Ceramill Artex, PMMA, Zolid
Amann Girrbach
Cerafusion Komet



A TOUR THROUGH SOME OF ZIRKONZAHN'S PRODUCTION CENTRES, ALL LOCATED WITHIN THE VICINITY OF THE HEADQUARTERS IN THE ITALIAN ALPS



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The new Zirkonofen Turbo. The first sintering process is performed at Premolaris

THE 'ALL IN-HOUSE' CULTURE TRILOGY: PART ONE

When it comes to deciding how to plan their production, companies first need to determine: in-house or outsourcing? This is an important choice, which has to be made with consideration of the biggest impacts on the company's vision and goals. In this magazine edition, we focus on the first of a three-part 'tour' of Zirkonzahn's production sites in the Aurina Valley (South Tyrol, Italy). The dental technical company exemplifies the 'all in-house' culture, owning five production sites located within the vicinity of the company's headquarters, where all their milling units, furnaces, scanners, implant prosthetic components, dental materials, burs and tools are produced.

Together with the production centre in Gais, Molaris I & II and Caninus, Premolaris is one of the firm's production sites. Built in 2021, it is dedicated to the assembly of milling units, furnaces, scanners as well as machine testing and customisation. The production facility reflects the company's philosophy in the clear values of accuracy, cleanliness and order – prerequisites to a precise work, which perfectly combine in the firm's design concept of product modularity. Founded and run by dental technicians (Enrico and Julian Steger, MDT), the company understands the needs of laboratories and aims to design complex technologies to be as transparent and comprehensive as possible, based on well-defined interfaces, to guarantee the greatest freedom of choice and processing. This means that not only can the users benefit from a high level of customisation according to their necessities, but they can also avoid any waiting for service or loaner machines, saving valuable time.

Machine components production takes place in Molaris I & II. In Premolaris, milling units, scanners and furnaces are assembled, calibrated and fine-tuned



The production site of Premolaris in South Tyrol

at individual stations according to standardised production processes. A new machine must pass through numerous quality stations before it reaches the final inspection and each employee is responsible for a specific assembly step, becoming an expert in what he or she does. For example, this is the place where spindles and orbits are assembled into the milling units with all hardware and software components: precision tests and measurements are carried out on each spindle before they are mounted in the machines and all data obtained is recorded and registered. Machine assembly is a very complex procedure and employees have to comply with strict checklists, which serve to coordinate the different working steps and ensure safety. An area of Premolaris is also dedicated to laser marking. Here, machines are marked with their names, and products that can be customised – such as Zirkonzahn Shade Guides – are laser-marked with the name of the clinic or the laboratory. A selection of glass cases, which the clients can choose from to personalise their equipment, is also available in this area. Premolaris is also the place where the first milling, scanning or sintering processes are performed on the new machines: only after the execution of the final checks and tests is the equipment ready to leave the production site, moving on to the on-site logistic department.

...To be continued in the next issue! [🔗](#)

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According to data originating from the Global Burden of Disease database, 1.1 billion cases of severe periodontitis (combining stage III and IV periodontitis) were prevalent globally in 2019, with an 8.44% increase detected between 1990 and 2019 – David Herrera, p92

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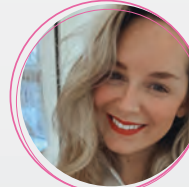
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**DR DIMITAR KRASTEV**

Dimitar graduated from the University of Plovdiv in 2004. After gaining four years of experience in Bulgaria, in 2008 he moved to the UK. He holds a master's degree in endodontics. He is based in Newbury, working at a private practice.

**PROF. LIVIU STEIER**

Liviu has been practising dentistry in Germany since 1985. He is a specialist in prosthodontics and in endodontics. He is clinical professor at University of Pennsylvania School of Dental Medicine in the US.

ENHANCED CPD

GDC anticipated outcome: C

CPD hours: one

Topic: Longitudinal tooth fractures

Educational aims and objectives:

To examine if an innovative dental fluorescence system can reveal cracks in affected teeth. This article qualifies for one hour of enhanced CPD; answer the questions on page 110 or scan the QR code.



Incomplete vertical cracks in teeth are a very frustrating event for patients and their dentists.

Many patients would not be able to pinpoint which tooth was the damaged one.

Most dentists would agree diagnosing 'cracked teeth' is the most challenging entity due to unclear and inconsistent symptoms.

In many cases, such teeth would show symptoms of hypersensitive exposed cementum, reversible or irreversible inflammation of the pulp and/or inflammation of the periodontium.

The most common clinical tests, such as periapical palpation, thermal stimuli, tenderness to percussion and mobility test, would have inconclusive outcome.

Radiographical examination would yield healthy bone and periodontal ligament space. One method that could be used in visualising the crack line is fluorescence light and special filters, which are present in the Reveal system.

CRACKS AND FRACTURES

In 2008, the American Association of Endodontists (AAE) published guidance regarding diagnosis and treatment of a cracked tooth, also known as 'cracked tooth syndrome'.

In this work, the term cracked tooth was replaced by 'longitudinal fracture', as the latter constituted a vertical defect that has developed in distance and over time.

The AAE established five different types of longitudinal fracture:

1. Craze lines
2. Fractured cusp
3. Cracked tooth
4. Split tooth
5. Vertical root fracture.

According to Lynch and McConnell (2002), there were four different causes that might lead to a vertical crack in a tooth:

1. Developmental factors
2. Restorative procedures
3. Occlusal factors
4. Miscellaneous reasons.

Teeth more likely to suffer longitudinal cracks are:

- Mandibular molar teeth
- Maxillary molar teeth
- Mandibular premolars
- Maxillary premolars (Krell and Rivera, 2007).

In 1981, Brady and Maxwell established that 20% of the patients referred to endodontists with unclear diagnosis had longitudinal cracks. A few years later, in 2006, Roh and Lee stipulated that vertical cracks in teeth could be even more common than was initially thought.

In the following two case reports, I used the Reveal visualisation system to investigate an upper right wisdom tooth and an upper right second molar tooth, both of which suffered longitudinal fractures.

CASE REPORT ONE

An 80-year-old male patient presented with an increased sensitivity to cold (which lasted for some time) and a mild on/off ache, affecting the right-hand site. He was not able to pinpoint which tooth was causing the symptoms, nor if it was on the maxilla or mandible.

I followed the guidance provided by the AAE and I established that tooth UR8 (upper right wisdom tooth), which had a full gold crown, was responsible for the problem. My diagnosis was:

- Symptomatic irreversible pulpitis
- Asymptomatic apical periodontitis – most likely due to an advanced longitudinal fracture (on the mesial side there was a narrow deep pocket and the bite test was positive).



FIGURE 1: The Reveal visualisation system

Dimitar Krastev and **Liviu Steier** examine if an innovative dental fluorescence system can reveal cracks in affected teeth

Reveal: cracked teeth ➔



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	Craze line	Fractured cusp	Cracked tooth	Split tooth	Vertical root fracture
Location	Enamel only, common on marginal ridges	Crown and cervical margin of root	Crown only or crown to root extension (depth varies)	Crown and root; extension to proximal surfaces	Root only
Direction	Occlusolingual	Mesiodistal and faciolingual	Mesiodistal	Mesiodistal	Faciolingual
Origination	Occlusal surface	Occlusal surface	Occlusal surface	Occlusal surface	Root (any level)
Aetiologies	Occlusal forces, thermocycling	Undermined cusp, damaging habits	Damaging habits, weakened tooth structure	Damaging habits, weakened tooth structure	Wedging posts, obturation forces, excessive root-dentine removal
Symptoms	Asymptomatic	Sharp pain with mastication and with cold	Highly variable	Pain with mastication	None to slight
Signs	None	None of significance	Variable	Separable segments, periodontal abscess	Variable
Identification	Direct visualisation, transillumination	Visualise, remove restoration	Biting, remove restoration	Remove restoration	Reflect flap and transilluminate
Diagnostic tests	None	Visible fractures of cusps, biting test, transillumination	Transillumination, staining, wedge segments (unseparable), isolated/narrow perio probing, biting test, magnification	Wedge segments (separable)	Reflect flap and transilluminate
Treatment	No treatment needed, aesthetic	Remove cusp and/or restore	Root canal treatment depends on pulpal and periapical diagnosis; restore with full cuspal coverage	Variable, must remove one segment, restore or extract	Remove tooth or fractured root; consider fixed and/or removable bridge, or implant
Prognosis	Very good	Very good	Always questionable to poor	Hopeless (if maintain intact) Variable (if remove segment)	Hopeless for fractured root
Prevention	None needed	Place conservative class II restorations; coronal protection (onlay undermined cusps)	Eliminate damaging habits (ice chewing etc); coronal protection (onlay undermined cusps)	Eliminate damaging habits; coronal protection (onlay cusps)	Minimise root dentine removal; avoid wedging posts; reduce condensation forces; use of carbon fibre posts

TABLE 1: Classification of longitudinal tooth fractures (AAE, 2008)

After a thorough discussion regarding options and outcome of the possible treatment to keep the tooth, and its alternatives, the patient decided to have it removed.

I used the Reveal visualisation system (Figure 1) without and with the use of fluorescein sodium dye solution to investigate the tooth after it was extracted.

Figures 2a, 2b and 2c show the mesial aspect of tooth UR8 on a digital photo, under fluorescence light and the tooth dyed with fluorescein sodium and investigated under the Reveal system.

Figures 3a, 3b and 3c show the distal part of the same tooth that has undergone the same assessment.

CASE REPORT TWO

A 60-year-old male patient was referred to my care regarding challenging diagnosis: increased sensitivity to cold.

Initial diagnosis of the referring dentist was general hypersensitivity on the right side, as the

radiograph did not show any abnormalities. I saw this patient four days after he visited his dentist. I approached the case using the AAE guidance for diagnosis of longitudinal fractures.

My findings were:

- Uncontrolled parafunctional habits
- Missing upper second premolar tooth
- Patient's diet included variety of nuts and granary bread
- Tooth UR7 (upper right second molar tooth): severe sensitivity to cold, lasting for longer than 30 seconds, increased sensitivity to heat stimuli, which lasted for 20 seconds, and the bite tests was positive.

My diagnosis was:

- Symptomatic irreversible pulpitis
- Asymptomatic apical periodontitis most likely due to a vertical crack.

As the tooth had a wide superficial to medium depth alloy filling, I recommended that the patient have it removed and investigated under dental operating microscope and the Reveal system.

Figure 4a shows tooth UR7 with the amalgam filling removed, and immediately a white line crack emerged between the mesial-buccal pulp horn and palatal one.

Figure 4b shows the tooth investigated under the Reveal visualisation system. Figure 4c shows the tooth dyed with fluorescein sodium followed by the Reveal system.

The benefit of fluorescence light examination was clear – it revealed the full length of the crack line – from mesial to distal aspect of the tooth.

DISCUSSION

Formulating an accurate diagnosis in clinical dentistry is paramount for the success of any treatment and prevention protocol.

Dentists should be familiar with all necessary evidence-based diagnostic tools, tests, systems, guidance and equipment to be able to transpire in diagnostic decision making (Pretty and Moupome, 2004).

Longitudinal fractures in teeth are hard to diagnose. The symptoms manifesting in cracked



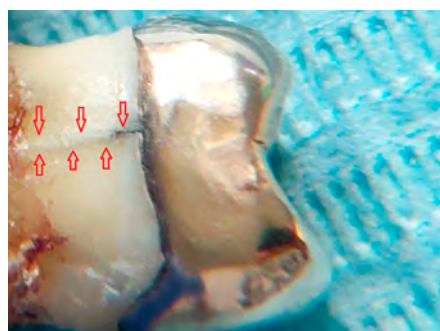


FIGURE 2A: Tooth UR8 – mesial. Digital photo. Red arrows show the longitudinal fracture lines

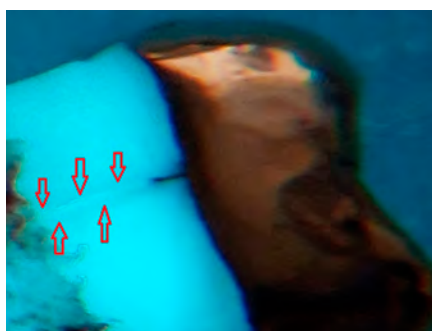


FIGURE 2B: Tooth UR8 – mesial. Reveal system. Red arrows show the longitudinal fracture lines



FIGURE 2C: Tooth UR8 – mesial. Reveal system and fluorescein sodium dye. Red arrows show the longitudinal fracture lines



FIGURE 3A: Tooth UR8 – distal. Digital photo. Red arrows show the longitudinal fracture lines

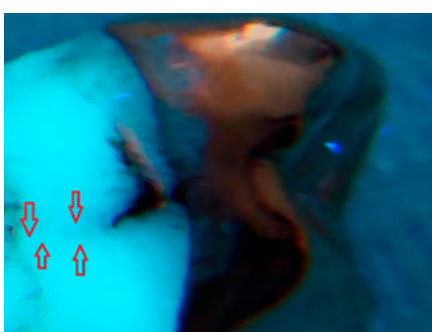


FIGURE 3B: Tooth UR8 – distal. Reveal system. Red arrows show the longitudinal fracture lines

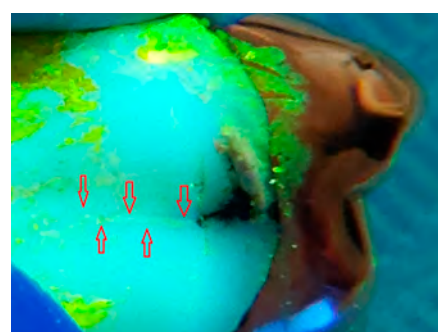


FIGURE 3C: Tooth UR8 – distal. Reveal system and Fluorescein Sodium dye. Red arrows show the longitudinal fracture lines

teeth vary in severity and type, and they can mimic exposed hypersensitive cementum, initial or an advanced pulp inflammation or even inflammation that has affected the apical periodontium (Lubisich et al, 2010).

In 2008, the AAE designed a classification of longitudinal tooth fractures (Table 1).

In many cases of longitudinal fracture, patients are very confused due to the mixed

sensation and pain that they are experiencing. Regrettably, many dentists struggle to diagnose the primarily cause of those symptoms (Banerji et al, 2010) due to generic subjective tests: periapical palpation, thermal stimuli, tenderness to percussion (TTP), mobility test.

Typically, general dentists do not use any of the following tests: periodontal probing, bite tests, electric pulp test (EPT), transillumination

and diagnostic surgery, as they consider them being in the scope of endodontists and/or restorative dentists (Alkhalifah et al, 2017).

Moreover, in 2015, Ricucci and colleagues demonstrated by histological examination the presence of bacteria in any type and size of crack in the teeth and an immediate pulpal response, which varied depending on the depth of the crack.



FIGURE 4A: Tooth UR7 longitudinal fracture, which has been investigated with a digital photograph. Red arrows show the vertical crack in the tooth. Notice how the dye has discoloured the crack in most of its length and areas of demineralisation



FIGURE 4B: UR7 longitudinal fracture, which has been investigated with the Reveal visualisation system. Red arrows show the vertical crack in the tooth. Notice how the dye has discoloured the crack in most of its length and areas of demineralisation

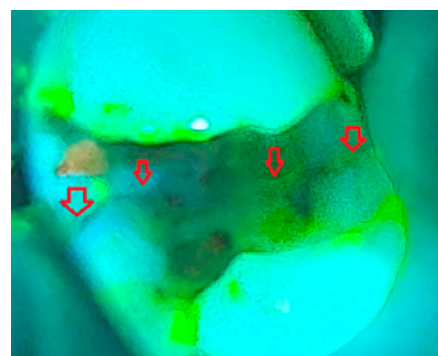


FIGURE 4C: UR7 longitudinal fracture, which has been investigated with the Reveal visualisation system and fluorescein sodium dye. Red arrows show the vertical crack. The dye has discoloured the crack in most of its length and areas of demineralisation

In 2018, a National Dental Practice-Based Research Network collaborative group evaluated 2,858 vital teeth with cracks and the associations of types of pain with crack-level, tooth-level and patient level.

The result showed that 45% of the cracked teeth had one or more symptoms, with increased sensitivity to cold being common in 37% of the affected teeth, followed by positive biting test (16%).

Those findings correlated with the chief symptoms and findings of both patients in this study report, which allowed the authors of this paper to introduce a new diagnostic tool for visualisation of longitudinal tooth fractures: fluorescence light and system of special filters (the Reveal dental fluorescence loupes and headlight system).

As clinicians are used to dental loupes and headlights, the way the Reveal system works is easy. It is also reliable as it uses fluorescence light available in two wavelengths: 405nm and 420nm.

FLUORESCENCE

Fluorescence has been used in dentistry for many years.

In 2007, Professor Laurance Welsh and Fardad Shakibaie described the principle of action: the gram-positive and gram-negative bacteria in the mouth, as a result of their activity, produce protoporphyrin IX (PPg) that, when exposed to ultraviolet-induced fluorescence (UVA), lighten in orange or red colour.

The most common bacteria responsible for caries and periodontal damage – *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans* and *Streptococcus mutans* – produce porphyrins during their metabolism (Yan et al, 2021) and this may be helpful to detect their presence in the longitudinal tooth fractures.

In these clinical cases, the authors used fluorescein sodium to enhance the diagnostic capabilities of the Reveal system, but one can see that even without it, the latter performed remarkably well.

CONCLUSION

Although a cracked tooth is a very frustrating event, early detection could lead to a favourable treatment outcome.

By following the AAE guidance for diagnosis and treatment of teeth with longitudinal tooth fractures, every dentist will be able to resolve the issue promptly and with fewer complications. The main symptoms were increased sensitivity to cold and tenderness on the biting test.

The Reveal visualisation system should be added to the array of tests, as it did not fail to diagnose the problem. On the contrary, it revealed the full extent of the crack line in both cases.

Having the dual headlight white and fluorescence light sources should make this system favourable to use in daily practice. [CD](#)

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siobhan.hiscott@fmc.co.uk

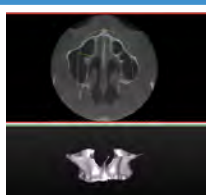
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Q&A

WITH...

DAVID HERRERA



Q. YOU ARE THE LEAD AUTHOR OF THE MAIN PAPER ABOUT THE NEW GUIDELINE ON TREATMENT OF STAGE IV PERIODONTITIS. HOW PERVASIVE IS STAGE IV PERIODONTITIS TODAY?

A. Periodontitis is the most common chronic inflammatory non-communicable disease of humans.

According to data originating from the Global Burden of Disease database, 1.1 billion cases of severe periodontitis (combining stage III and IV periodontitis) were prevalent globally in 2019, with an 8.44% increase detected between 1990 and 2019.

Q. WHAT ARE THE GOALS OF TREATMENT OF STAGE IV PERIODONTITIS?

A. Stage IV periodontitis requires an interdisciplinary approach for treatment: on one hand, the periodontal tissues need to be properly managed to control inflammation, but, on the other hand, there is a need for rehabilitation of the impaired dentition, due to sequelae as tooth loss, masticatory disfunction, and occlusal collapse.

Therefore, firstly, the recommendations to be followed are common with the ones already developed and published in the previous guideline for the treatment of periodontitis in stages I-III. Those recommendations were presented in four steps of treatment:

- Step one aims to control bacterial dental plaque/biofilms around teeth, including proper hygiene measures to be performed by the patient, and risk factor control, focusing on the two main risk factors of periodontitis: smoking and diabetes. Thus, in step one of periodontal therapy, behavioural changes and motivation are crucial
- Step two aims to clean bacteria below the gum line, with a very important intervention called 'subgingival instrumentation', which,

in specific cases, may be associated with adjunctive interventions: use of different antimicrobials or other anti-inflammatory, host-response modulators or antioxidant micronutrients

- Step three may only be needed in severe cases, since periodontal tissues will be re-evaluated four to 12 weeks after steps one and two of therapy. If the periodontal inflammation is already controlled (bleeding and periodontal pocketing are the most important outcomes for assessing success), patients will go directly to step four. If the periodontal inflammation is still present in some teeth, step three may be considered, either with subgingival re-instrumentation or with periodontal surgery, which may include interventions aiming to regenerate periodontal tissues at specific sites
- Step four, or supportive periodontal care, is the last step and mandatory for all patients, as well as crucial to maintain successful results. It is based on regular professional interventions to control bacterial plaque/biofilms, as well as the patient's compliance with oral hygiene habits and risk factor control interventions.

Still, there is a major difference between the treatment of other periodontitis and stage IV periodontitis – which is the need to maintain/re-establish a functional dentition and the necessity for a rigorous supportive care programme prior to, throughout, and following the rehabilitation phase of care.

Among the additional multidisciplinary interventions, orthodontic therapy, and implant- or tooth-supported prosthetic rehabilitations can be mentioned.

Q. WHAT ARE THE MOST IMPORTANT DIAGNOSIS AND TREATMENT RECOMMENDATIONS THAT SHOULD BE HIGHLIGHTED FOR THE GENERAL PUBLIC?

A. Due to the complexity of stage IV periodontitis, the clinical assessment is crucial and should include five relevant aspects:

1. Evaluation of the amount of periodontal breakdown, patient function and aesthetics

STAGE IV PERIODONTITIS

2. Number of teeth already lost, and of those lost due to periodontitis
3. Prognosis of each remaining teeth, especially those that may be involved in a tooth-supported prosthesis
4. Careful evaluation of restorative factors, in order to evaluate the available options for rehabilitation, including the need of using dental implants
5. Overall prognosis, including the presence of systemic risk factors.

This careful analysis allows us to prepare an appropriate treatment plan, that will be complex and will require a detailed assessment of what is technically and biologically feasible, cost-effective, and in line with the patient's preferences and expectations.

However, and despite this complexity, most cases of stage IV periodontitis can be successfully treated, maintaining the natural dentition in a state of adequate health and function.

The guideline emphasised the following key general recommendations:

- Patients should be informed in detail about their condition, the various treatment options and associated risks, including the need for periodontal therapy, the design of the rehabilitation, and the sequence of interventions
- The starting point for treatment of stage IV periodontitis initially attempts to preserve all periodontally compromised teeth that are deemed rational to treat
- It is crucial to frequently assess motivation and adherence to self-performed dental plaque/biofilm control and risk factor control throughout the course of treatment and during supportive periodontal care
- It is mandatory that restorations should be designed to achieve function and aesthetics while enabling effective self-performed oral hygiene and professional tooth cleaning.

Q. HOW SHOULD ORAL HEALTHCARE PROFESSIONALS ENCOURAGE PATIENTS TO FOLLOW ADVICE REGARDING ORAL HYGIENE AND CONTROL OF RISK FACTORS, FOR EXAMPLE?

A. Patient behavioural change is crucial in the treatment of all types of periodontitis, but it becomes even more important in stage IV periodontitis, due to the complexity of the cases, and the added risks.

Patient habits and behaviour are considered in the recommendations in steps one and four of periodontal therapy, and described in our 2020 guideline for the treatment of periodontitis in stages I-III.

On one hand, dental plaque/biofilm control by the patient needs to include some intervention

for oral hygiene habits, both in terms of training (toothbrushing with manual or powered toothbrushes, interdental cleaning, use of adjunctive agents in dentifrices or mouth rinses) and motivation for behavioural changes – that needs to be frequently re-assessed, with additional instructions and motivation. On the other hand, intervention for systemic risks factor control includes the implementation of programmes for smoking cessation that could be performed at the dental clinic, and careful advice for diabetes patients to strictly follow the indications made by their medical professional.

Q. YOU WERE SCIENTIFIC CHAIR OF THE RECENTLY HELD EUROPERIO10 IN COPENHAGEN. WHAT WERE THE MAIN NOVELTIES OF THE SCIENTIFIC PROGRAMME?

A. At Europerio10 we kept the most attractive formats that we had seen in previous Europerios, especially those that proved to be successful at Europerio9 in Amsterdam in 2018, but we also prepared a number of new session formats. One of the highlights of Europerio9 was the live surgery performed by Professor Giovanni Zucchelli. Thus, this year in Copenhagen, we planned three live surgeries.

Two of them were mucogingival surgeries, performed by two experts in the field facing a similar case, but treated with different techniques: Dr Ion Zabalegui, from Spain, and Professor Massimo de Sanctis, from Italy. And then we have had one more live surgery, which focused on bone regeneration, performed by Dr Istvan Urban, from Hungary. Another unforgettable session in Amsterdam was the 'nightmare' session, with cases that went wrong and all the things that can be learnt from that.

At Europerio10 we scheduled two 'nightmare' sessions, one on periodontics chaired by Professor Lior Shapira, and another on implant dentistry, chaired by Dr Adrián Guerrero. New formats were also introduced: as examples, clinical sessions, mainly based on clinical videos; debates, to promote discussions; or the presentation of the European Federation of Periodontology (EFP) clinical practice guidelines, both the one published in the *Journal of Clinical Periodontology* in 2020 on the treatment of periodontitis in stages I-III, and the one recently published this June, on the treatment of stage IV periodontitis.

Also, in many sessions, the Europerio10 app allowed attendees to be involved by voting or posing questions.

Q. WHAT WAS THE MOST CHALLENGING PART OF BEING SCIENTIFIC CHAIR OF EUROPERIO10?

A. Being in charge of the scientific aspects

of Europerio10 has been one of the most demanding and more rewarding tasks in my periodontal career.

When the chair of Europerio10, Professor Phoebus Madianos, invited me to become scientific chair, I knew that it would be challenging, but it's fair to say that the support given by some colleagues, especially by Professor Mariano Sanz (one of the most experienced persons for this task, as he was scientific chair of Europerio2 and Europerio8, as well as chair of Europerio5) has greatly helped me to assume this role with pride and responsibility.

The main challenge was the magnitude of Europerio10, with four big auditoriums running in parallel in the main programme, four days from Wednesday until Saturday.

We brought on board some of the most important and best-known speakers, especially from Europe, but also other experts from all around the world had their role to play.

We also included new blood – young talents, with a special focus on female talents. For that, the proposals made by all our 37 EFP member societies was very useful. In the main programme, we had 135 speakers from 31 countries.

But this challenging task has also been very rewarding, especially due to the very positive responses from chairs and speakers, who are the best experts worldwide in their assigned topics. 

EUROPERIO11

Europerio11 will take place in Vienna, Austria in 2025. Visit www.efp.org for updates and the latest news.



EUROPERIO10 KEY STATS

- More than 7,000 participants from more than 100 countries
- 66% of participants under 45 years of age and 33% under 35 years
- Original research presented in over 900 scientific abstracts
- 41 scientific sessions on emerging issues of interest for practitioners, scientists and academics
- Over 130 top speakers from more than 30 countries
- 50% less printed materials than Europerio9.



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ANNA MIDDLETON

Anna is a multi-award-winning dental hygienist and therapist. She started 'London Hygienist' with the mission to change the way oral health care is delivered to patients and improve access to dental services.

BRIDGING THE GAP BETWEEN EVOLVING EVIDENCE AND SUPPORTING PATIENT BEHAVIOUR CHANGE

Following the Hygienist Advisory Panel (HAP) last year, Johnson & Johnson Ltd, the makers of LISTERINE®, followed up with four members of the group to talk more about key issues affecting dental hygienists and dental therapists

Over the coming months, each of these four – Laura Bailey, Alison Edisbury, Anna Middleton, and Benjamin Tighe – will explore important topics to shine a light on the challenges and offer support for both dental professionals and patients, including:

- Oral health – is there a need for a change in ethos?
- Exploring the patient-friendly consensus
- The human and economic cost of periodontal disease.

On the subject of bridging the gap between evolving evidence and supporting patient behaviour change, we asked Anna Middleton the following questions.

Q. HOW IMPORTANT DO YOU THINK IT IS FOR DENTAL PROFESSIONALS TO REVIEW THE EVIDENCE BASE REGULARLY IN TERMS OF THEIR SCOPE OF PRACTICE?

A. With the evidence base continually growing, it is fundamentally important for dental professionals to stay well-informed and know how to distinguish between robust and weaker information, and understand when, why and how to amend any clinical practices.

Q. HOW DO YOU ENSURE YOU REMAIN UP TO DATE WITH THE EVOLVING EVIDENCE BASE?

A. I like to keep up to date by making sure I complete various CPD courses, attend relevant events and being a member of societies, such as the BSP and BSDHT.

Q. HOW DO YOU GO ABOUT MAKING SURE YOU ARE BASING YOUR DECISIONS ON ROBUST EVIDENCE?

A. Professional knowledge is important in the application of guidelines and being able to evaluate that information critically is how I make my decisions, and to do that I refer to the GRADE system assigned to the evidence.

Q. HOW MUCH OF A CHALLENGE IS IT FOR YOU STAY AHEAD OF THE CURVE?

A. It can be challenging at times, as our advances in science and medicine are continually evolving, and I would say, even at a more rapid rate than before. When you have new information to process and appraise, it can take time to evaluate the quality of evidence, as well as how then to implement that into practice.

Q. GIVEN YOUR EXPERIENCES, HOW DO YOU SUGGEST OTHER DENTAL PROFESSIONALS STAY ABEAST OF THE BEST POSSIBLE INFORMATION AND PUT IT TO GOOD USE?

A. Ensure you are a member of relevant societies and try to attend as many courses/events as possible to keep up to date. Talk to your peers and make use



of the professional forums and press resources we have available to us.

Q. WHEN IN THE PAST CAN YOU REMEMBER CHANGING SOMETHING DUE TO NEW EVIDENCE? WHAT WAS IT AND WHY WAS IT IMPORTANT GIVEN YOUR SCOPE OF PRACTICE?

A. While practising evidence-based dentistry, I believe it is still important to remember we treat individuals, so we need to be able to adapt accordingly to ensure we are providing the best possible care for our patient and their needs, which can change all the time while they are in our care. For example, I qualified in 2015 and already there are changes in guidelines and evidence from when I was training. Such as the 'spit, don't rinse' message.

Q. TO WHAT EXTENT DID YOU FIND THE HAP HELPFUL IN TERMS OF PROVIDING AN EVIDENCE-BASED ORAL HEALTH UPDATE?

A. It was really helpful to have the session lead by Prof. Chapple and Prof. Deery – they helped us to understand how and why the evidence has changed and what that means for how we manage our patients' oral health, while also providing us with professional development in how to appraise evidence in the future.

Q. DID THE PRESENTATIONS AND/OR DISCUSSIONS ON THE DAY LEAD YOU TO REASSESS ANYTHING IN PRACTICE? IF SO, WHAT AND WHY?

A. It was really reassuring to know that applying a more multi-dimensional approach to patient care IS how we should be practising, not just to stick rigidly to applying potentially outdated guidelines, and to keep reviewing our practice as well as our patients' needs at every visit. For example, if a patient presents and their oral hygiene has slipped, we will naturally

remind them of best oral hygiene practices but what if for a particular period of time we introduce adjuncts to support their present needs and then review again at subsequent visits?

Q. WAS THERE ANYTHING NEW TO YOU ON THE DAY? IF SO, WHAT WAS IT? HOW DID YOU FEEL ABOUT THAT?

A. It was really exciting to see the research and evidence that is emerging around chemical adjuncts to support better oral health and the results from the trials.

Q. HOW DO YOU GO ABOUT BRIDGING THE GAP BETWEEN THE EVIDENCE BASE AND CLINICAL GUIDELINES WHEN IT COMES TO MEETING THE SPECIFIC NEEDS OF YOUR PATIENTS?

A. Life is in a constant state of flux. What suits one patient one day, might change the next day. When patients come to see me, I use information gathered at that appointment, such as their bleeding score, their stress levels, the fact their electric toothbrush has stopped working, along with anything else they may share with me. Based on that information, I then will decide what is the best advice and treatment for that patient that day. Then, when I see them next time I will review and make adjustments accordingly, while all the time co-signing my decisions back to strong, evidenced-based guidelines.

Q. HOW DO YOU SHARE NEW INFORMATION WITH PATIENTS, TO SUPPORT THEM IN ANY NECESSARY BEHAVIOUR CHANGE?

A. Face-to-face in clinic by explaining why they may have a certain oral health condition, what can be done to manage it and why I am giving them the advice I am. I am also passionate about sharing information on social media to help

educate and support patients who may not personally be seeing me.

Q. HOW DID THE HAP CONSENSUS SUPPORT YOU IN PRACTICE, IN TERMS OF YOUR ABILITY TO PROVIDE NEW INFORMATION IN A MOTIVATING WAY?

A. I think, for me, I am in a fortunate position where patients book with me under 'direct access', so they are already independently seeking a clinician to meet their needs. This means that we almost go on a journey together, as I am always learning and evolving, and it is exciting as they are inquisitive and open to the advice, because they are taking an internal locus approach to their wellbeing. While this may not be the case for everyone, the point is that, through the right forms of communication and motivation, we can make a change and that's what really excites me about being in dentistry and being a part of the HAP. 

EVIDENCE-BASED MOUTHWASH USE SUPPORTED BY HYGIENIST ADVISORY PANEL CONSENSUS



When Johnson & Johnson Ltd. brought together a group of dental hygienists and therapists for the very first Hygienist Advisory Panel meeting, they shared their views in relation to plaque management. They also explored the benefits and any limitations of mechanical cleaning, as well as possible adjunctive support in the form of a chemotherapeutic mouthwash.

Building on the outcomes of the earlier National Advisory Panel formed of key opinion leaders, the group agreed on the following consensus: 'Healthy gums don't bleed when brushed. Twice daily brushing along the gum line and cleaning in between the teeth is essential to support a healthy mouth. Fluoride mouthwashes clinically proven to reduce germs (plaque) offer additional benefit.'

Below the age of 7

'Spit don't rinse.'

Over the age of 7

'For better gum health, after brushing spit and then rinse with a fluoride mouthwash that is clinically proven to reduce germs (plaque).'

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PERIODONTAL
DISEASE,
CONSIDERING
NOT ONLY THE
FINANCIAL
IMPLICATIONS
OF TREATING
PERIODONTAL
DISEASE AT
VARIOUS STAGES
OF DEVELOPMENT
BUT ALSO HOW
IT AFFECTS
SUFFERERS'
QUALITY OF LIFE**



BENJAMIN TIGHE

Benjamin is a full-time dental therapist and a Tutor Dental Therapist at the Eastman Dental Hospital.

THE HUMAN AND ECONOMIC COST OF PERIODONTAL DISEASE

Following the Hygienist Advisory Panel (HAP) last year, Johnson & Johnson Ltd, the makers of LISTERINE®, followed up with four members of the group to talk more about key issues affecting dental hygienists and dental therapists

For this, each of these four - Benjamin Tighe, Laura Bailey, Alison Edisbury and Anna Middleton - will be exploring important topics to shine a light on the challenges and offer support for both dental professionals and patients, including:

- Oral health – is there a need for a change in ethos?
- Exploring the patient-friendly consensus
- Bridging the gap between evolving evidence and supporting patient behaviour change.

Here, Benjamin Tighe explores the cost of periodontal disease from a dental hygiene/therapy perspective, taking into consideration not only the financial implications of treating periodontal disease at various stages of development but also how it affects sufferers' quality of life, on a physical health level and emotionally.

Q. WHAT STRUCK YOU THE MOST ABOUT THE ECONOMIST INTELLIGENCE UNIT'S REPORT, TIME TO TAKE GUM DISEASE SERIOUSLY: THE SOCIETAL AND ECONOMIC IMPACT OF PERIODONTITIS?

A. After reading *The Economist's* White Paper, I think the most shocking takeaway was that there are more years lost to disability from periodontitis than any other disease. Also, that it's now classed as being a social disease due to the prevalence being clustered in socioeconomically deprived areas. I've always known that, but when you see it in a paper it hits home. I've personally delivered treatment for free, in my own time, as I've known the patient is unable to pay for it. That's sad.

Q. HOW HAVE YOU TAKEN THAT INFORMATION ON BOARD AS A PRACTISING DENTAL PROFESSIONAL?

A. It's a difficult one. I'm privileged enough to work in an affluent area, but I'm aware of the difficulties in accessing treatment and the costs of treatment across the country. My background is education, so, for me, it all comes back to prevention. Getting out there, into communities, schools, health centres, and providing the tips, tools and techniques to achieve and maintain a healthy mouth.

I've also been spending a lot more time with patients discussing the impact plaque biofilm has on their overall health and making a lot more referrals to their GPs for things like diabetes, menopause, and blood pressure. A patient has even said, "Wow, you're so much more than a hygienist."

Q. YOU SEE FIRST-HAND THE PERSONAL COSTS OF PERIO DISEASE. WHAT DO YOU TEND TO SEE AND HOW DO YOU HELP PATIENTS OVERCOME THEM?

A. The first-hand personal costs of periodontal disease, sadly, is usually a lot of shame and embarrassment. When new patients come to see me, they usually spend the first few minutes apologising for the state of their mouth and explaining how it got that way.

To me, their biggest achievement is that they've made it to my chair. The past is the past, it's about how we work together as a team and how we get them back to health. My role as a hygienist isn't just to 'clean' your teeth. We're here to encourage and support you to reach your goals – which is ultimately health and confidence driven. If you understand why you need to do something, you're more likely to do it. It's common, due to time constraints, for clinicians to just tell the patient what to do and hope they do it, but I've found sitting down with the patient and explaining the rationale behind your advice yields far superior results.

Q. GIVEN THE EVIDENCE BASE, AT WHAT STAGE SHOULD PERIO DISEASE BE ADDRESSED AND WHY?

A. Personally, I would like to see perio disease addressed at the stage of health. By that I mean ensuring patients never develop disease. Educating the patient to the consequences of not looking after their own mouth and seeing us (hygienists) regularly would help prevent any disease forming in the first place. It's cheaper for the patient in the long run and better for their overall health. However, I know that probably isn't realistic. *The Economist's* White Paper suggests intervening at gingivitis is best¹. This is when the disease is reversible and there hasn't been any long-term structural damage to the supporting bone.

Q. HAVE YOU CHANGED YOUR POSITION ON THIS AT ANY POINT?

A. Bleeding in the mouth should never happen but it seems to have become normalised. I often hear people say, 'My gums have always bled'. We need to move away from this, it's not okay and it's your body telling you something is wrong. If patients are aware of the signs from the start and know when they see bleeding they need professional help, we can intervene and prevent it getting worse.

Q. HOW DO YOU THINK USING THE HAP CONSENSUS CAN HELP?

A. When we consider the consensus from the Hygienist Advisory Panel, I think its main benefit comes back to education. The HAP was a little more patient focused. Receiving and following advice can sometimes be overwhelming for patients. I've seen first-hand the confusion on patients' faces when you give them a lot of instructions, so it's about simplifying the message. The emphasis is still on the mechanical plaque removal, but we're saying that using a fluoride mouthwash that reduces plaque offers ADDITIONAL benefit. Who doesn't want additional benefits?

Q. WHAT CONSTITUTES SUCCESS FOR YOU WHEN PROVIDING ONGOING AND LONG-TERM PERIO CARE FOR A PATIENT?

A. When providing ongoing and long-term periodontal care, for me success comes down to stability. Once the patient is deemed healthy or stable, the patient and I need to work together as a team to ensure that doesn't change. I obviously want the patient to be happy, to understand my



advice and achieve the goals set. If we achieve all of that then the treatment has been successful.

Q. HAS ADDING A MOUTHWASH TO MECHANICAL CLEANING HELPED WITH PLAQUE CONTROL OUTCOMES? WHAT HAVE YOU EXPERIENCED IN PRACTICE IN THOSE TERMS?

A. Adding a mouthwash to mechanical cleaning has genuinely helped with plaque control outcomes. Historically, I've always been anti mouthrinse. From university, we were told that mouthrinse removes all the fluoride in toothpaste and I think that is the reason why so many hygienists are reluctant to recommend it. But, since Professor Chapple presented the evidence at the Johnson & Johnson HAP, I've been selectively advising its use and been surprised with the results. It does seem to be helping reduce plaque levels and keeping the tongue cleaner. There are definitely chemical qualities that help reduce plaque, but it also serves as a nice reminder for the patient to think about their mouth.

Q. WHAT WOULD YOU LIKE TO SEE CHANGE IN THE NEXT FEW YEARS TO REFLECT THOSE CHALLENGES BOTH DENTAL PROFESSIONALS AND PATIENTS ARE EXPERIENCING IN THE CURRENT CLIMATE IN TERMS OF PERIO DISEASE?

A. In the future I would like to see more public health funding. We have to thank brands for educating the patients, they've done a brilliant job, but it would be nice to see more of the profession delivering the advice. I think it might make us more

approachable and, hopefully, break down some barriers.

Also, more education and interdisciplinary working – I've seen first-hand the difference it can make to patients when I've liaised directly with consultants, doctors and nurses. We put the mouth back into the body and start to look at the patient as a whole.

Finally, easier access to treatment for patients and more clinical freedom for us as dental hygienists and therapists. Under the NHS it can be more challenging but in the private sector we're able to work autonomously and deliver a high standard of care with fewer time constraints. 

REFERENCE

1. Time to take gum disease seriously. The societal and economic impact of periodontitis. *The Economist Intelligence Unit Limited* 2021.

EVIDENCE-BASED MOUTHWASH USE SUPPORTED BY HYGIENIST ADVISORY PANEL CONSENSUS



When Johnson & Johnson Ltd. brought together a group of dental hygienists and therapists for the very first Hygienist Advisory Panel meeting, they shared their views in relation to plaque management. They also explored the benefits and any limitations of mechanical cleaning, as well as possible adjunctive support in the form of a chemotherapeutic mouthwash.

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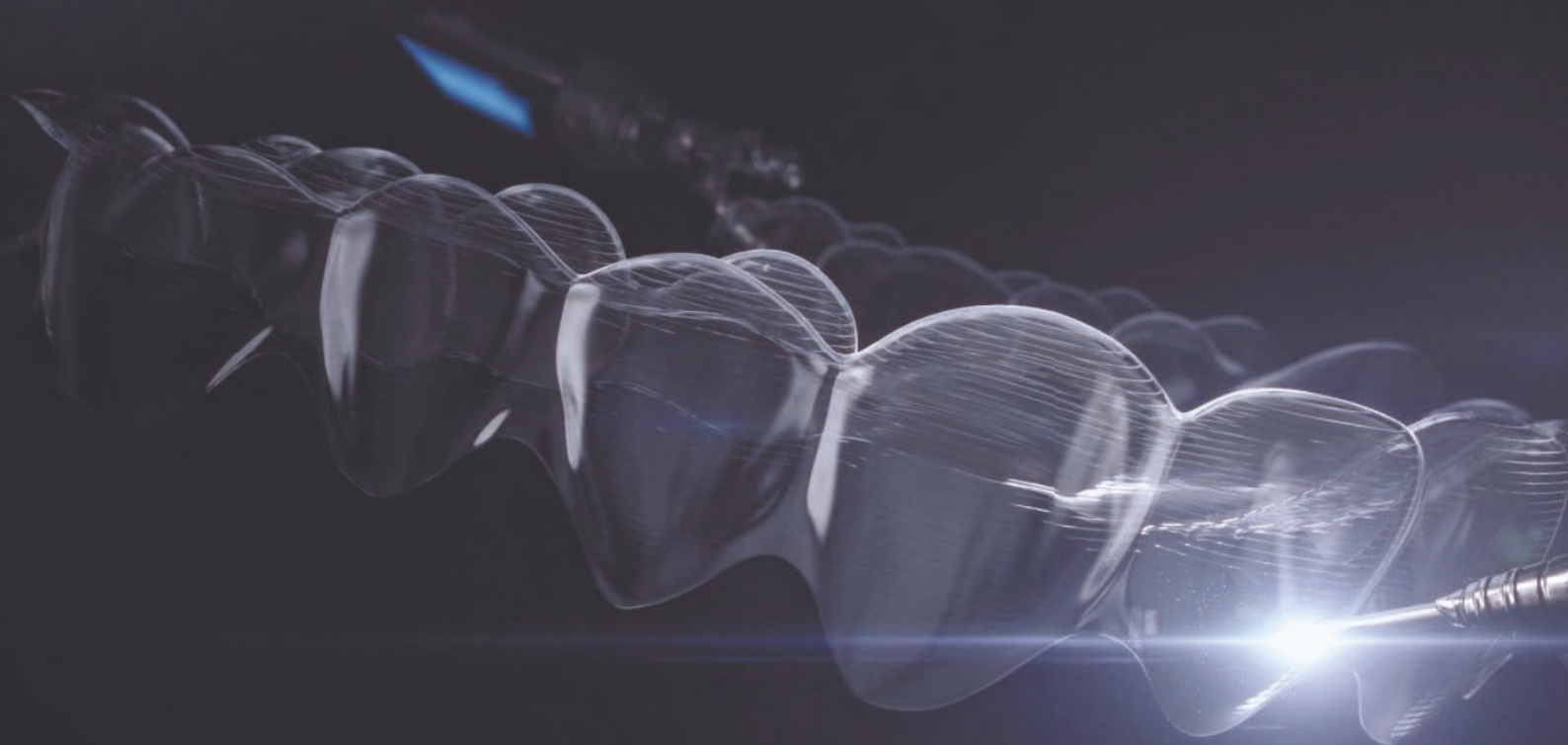
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1. The Guardian <https://www.theguardian.com/society/2009/aug/08/dentists-earnings-nhs-private-practice>. Accessed December 2017.

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ORTHODONTICS

OMAIR AFZAL

Improving oral health and aesthetics

100



NIKHIL GOGNA

Enhancing orthodontics

104



Compliance with any sort of medical treatment is essential for optimal outcomes and getting the patient on board is key prior to starting treatment – Omair Afzal, p100

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**DR OMAIR AFZAL**

Omair is principal dentist of Sutton Aesthetic Dentistry. Since qualifying from the University of Birmingham in 2005, he has completed extensive postgraduate training in various areas of dentistry, including orthodontics, implant dentistry and prosthodontics.

ENHANCED CPD

GDC anticipated outcome: C

CPD hours: one

Topic: Orthodontics

Educational aims and objectives:

To discuss utilising removable clear aligners to treat relapsed orthodontic treatment. This article qualifies for one hour of enhanced CPD; answer the questions on page 110 or scan the QR code.



A female patient attended the practice, expressing an interest in orthodontic treatment. She had undergone comprehensive orthodontics as a child but did not wear her retainers and so had experienced relapse. She was keen to proceed with removable aligners instead of a fixed treatment option.

TREATMENT PLAN

The initial clinical assessment demonstrated a class I canine molar relationship on both the right- and left-hand side, as well as gingival recession on the lower 3s and 4s, and mild incisor crowding (Figures 1 to 7). All possible treatment options were discussed with the patient, including the benefits, risks and limitations of each. The treatment options were:

1. Fixed orthodontics – for both the upper and lower arches, or just the one. The price and estimated length of treatment (five to seven months) was provided
2. Removable aligners – for both the upper and lower arches. The price – which would be dependent on the number of aligners required – was discussed, as well as the approximate treatment time (six to nine months). The need for refinement and retention was highlighted.

As per her initial comments, the patient rejected fixed orthodontics in favour of the more discreet aligners. An appointment was booked with the orthodontic therapist to perform the orthodontic assessment, which included digital impressions, panoramic X-rays and clinical photographs.

The following was recorded at this appointment:

- Skeletal class I
- Average FM angle
- No transverse asymmetry
- No TMJ clicking
- Competent lips
- Average lower face height
- Average nasiolabial angle
- No erosion
- Habits – none

- Class I incisor relationship
- Class I buccal occlusion on left and right
- 4mm overjet
- 20% overbite
- Upper and lower centrelines coincident
- No displacement on closure
- 3mm upper and lower anterior crowding.

It was also determined that the patient was a smoker – though she was trying to quit and was down from 10-plus per day to one or two per day. She also drank approximately one to two units of alcohol a week. The patient's general oral hygiene was poor, and was experiencing bleeding when brushing. There was calculus on both lingual and palatal surfaces and in all interdental areas, as well as significant inflammation and scores of threes across the board for her basic periodontal examination (BPE).

The importance of improving oral health before any further treatment was emphasised to the patient. Professional cleaning was conducted to remove the calculus using hand instruments – this was performed during a time of restrictions in the dental practice due to COVID-19.

Detailed oral hygiene instructions were given as well as an electric toothbrush demonstration to help her focus on the gingival margins when cleaning.



FIGURE 1: Initial presentation, full face

Omair Afzal presents a case utilising removable clear aligners to treat relapsed orthodontic treatment

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Specialist Orthodontist,
Smileville Orthodontics

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FIGURE 2: Initial presentation, close up



FIGURE 3: Initial presentation, intraoral



FIGURE 4: Initial presentation, right-hand side



FIGURE 5: Initial presentation, left-hand side



FIGURE 6: Initial presentation, upper jaw



FIGURE 7: Initial presentation, lower jaw

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FIGURE 8: Final result, close up



FIGURE 11: Final result, left-hand side



FIGURE 14: Final result, full face

TREATMENT SIMULATION

Digital impressions with the 3shape Trios intraoral scanner and clinical photographs were taken for the patient's records. The relevant images were uploaded to the Clearcorrect doctor portal, which returned a 3D treatment set up and treatment simulation. This gave the patient an idea of what kind of results she could expect.

The patient was made aware that results could not be guaranteed; it was explained that this was an estimate only and that the outcome may vary slightly in real life. Plus, the outcome would be dependent on the patient's compliance with aligner wear.

The treatment set-up predicted that at least 13 aligners would be required to align the teeth. The patient gave informed consent to proceed.

TREATMENT

Orthodontic treatment commenced, and everything went as planned for the first three aligners. During the review appointment, aligners three to six were provided and



FIGURE 9: Final result, intraoral



FIGURE 12: Final result, upper jaw



FIGURE 15: Before and after

attachments placed in flowable composite as per the guide to encourage correct movement.

The third lower aligner was still very tight, so the importance of wearing the aligners for a minimum of 22 hours a day was reinforced.

Tracking was as predicted for the following two sets of three aligners, with the use of Chewies aligner tray seaters highlighted to the patient. Interproximal reduction (IPR) was performed progressively as required. Treatment continued through to aligner 18, when it was agreed that refinement would be needed in the lower arch.

The final two aligners were provided and the patient returned to the practice for new digital impressions. Five refinement aligners were worn in the following weeks, before a final intraoral scan was taken for fabrication of the retainers – which she was advised to wear at night.

OUTCOME AND DISCUSSION

To enhance the colour, tooth whitening was performed using Evolution 16% carbamide peroxide gel (Enlighten) in removable trays, which were worn at night for two weeks.

The upper centrals were chipped. After discussion, composite edge bonding was provided on the UR2 to UL2. The restorations



FIGURE 10: Final result, right-hand side



FIGURE 13: Final result, lower jaw



FIGURE 16: Before and after

were smoothed off and polished, the bite checked and postoperative photos taken (Figures 8 to 14). The patient was delighted with the outcome (Figures 15 and 16).

Cosmetic dentistry is a key driver for many new patients attending my practices, and if this can be packaged with a functional and preventive benefit in a minimal invasive way, we can provide the best care for our patients. Compliance with any sort of medical treatment is essential for optimal outcomes and getting the patient on board is key prior to starting treatment. This is even more important with regards to disciplined wear of clear aligners. [CD](#)

PRODUCTS USED

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Enhancing orthodontics

Nikhil Gogna shares two tips that strengthen his orthodontic clinical practice

I have always had a fascination with skeletal anchorage and recognise it as an important component to my treatment planning and mechanics. Having worked with, and spoken to, many orthodontists with varying degrees of experience using temporary anchorage devices (TADs), I've noticed mixed reviews – usually due to their invasive nature and failure rate. The British Orthodontic Society's national TAD audit published in 2015 highlighted a 24.2% failure rate of 1,000 TADs placed by orthodontists in the UK (Bearn and Alharbi, 2015).

With practice, I've become proficient in their use and prefer using them palatally and/or buccally with most of my failures occurring in the mandibular arch.

Additionally, a challenge is to convince a patient to accept them. To overcome this, I commonly describe TADs as 'studs' or 'micro implants' rather than screws!

Figure 1 shows a case where I would typically incorporate TADs. The malocclusion is complicated by hypodontia of the upper left lateral incisor resulting in mesial migration of the upper left canine thus becoming a full unit class II relationship.

The treatment plan involved space redistribution for a pontic in the upper left lateral incisor space and therefore requiring canine retraction – an anchorage demanding movement.

Alternative methods can include the use of push coil between the upper left central incisor and left canine (but this will cause a centreline shift to the right, proclination of the upper incisors and



FIGURE 1: A case where I would typically incorporate TADs

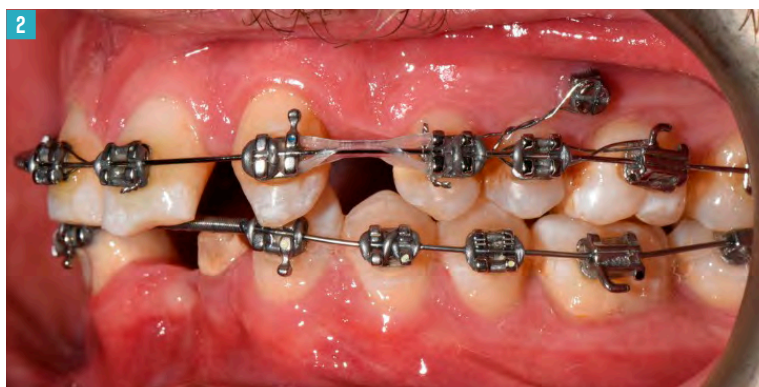


FIGURE 2: Photograph taken on 9/11/2020

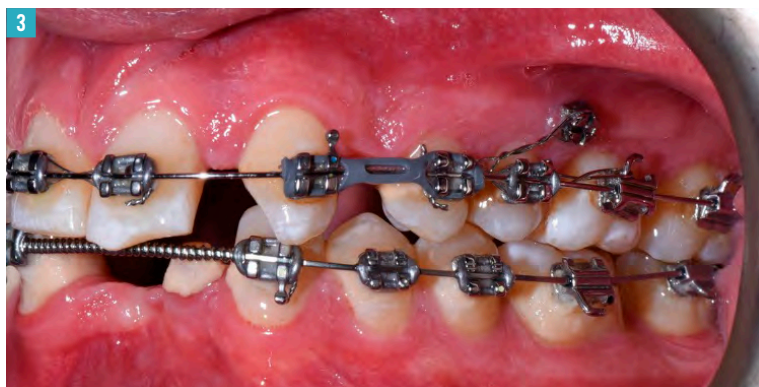


FIGURE 3: Photograph taken on 4/12/2020



NIKHIL GOGNA

BDS (HONS) MFDS
RCPS (GLASG)
DCLINDENT (ORTH)
MORTH RCS (ENG)
FDS RCS (ENG)

Nikhil is an award-winning consultant-trained specialist orthodontist who has a passion and ambition to deliver high quality functional, stable and aesthetic dentistry.

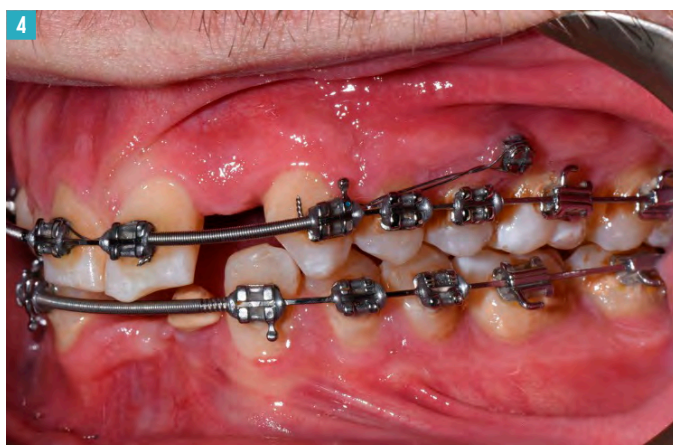


FIGURE 4: Photograph taken on 30/4/2021 shows progressive successful retraction of the UL3 using indirect anchorage over five months



FIGURE 5: Initial presentation – anterior open bite



FIGURE 6: Treatment



FIGURE 7: Final result

subsequent round tripping) or class II elastics, which relies on patient compliance.

In such cases, I've found success placing TADs buccally as access is advantageous and have a choice of applying direct or indirect anchorage to the canine.

Figures 2, 3 and 4 show progressive successful retraction of the UL3 using indirect anchorage over five months.

COUNTER FORCE ARCHWIRES

Counter force wires are used for multiple reasons during orthodontic treatment, including:

- Overbite reduction
- Initial levelling
- Maintenance of anterior torque.

Such wires have a reverse curve built in saving the clinician time of wire bending and preventing unwanted vectors having an influence on tooth movement.

An alternative use of such wires includes anterior open bite correction, which aim to

extrude the upper incisors and intrude the posterior buccal segments.

Figures 5, 6 and 7 demonstrate an anterior open bite case that utilised reverse curve of Spee nickel titanium wires (16×22 and 19×25), as well as settling elastics to reduce the lateral open bites created while using such wires.

To aid extrusion of the upper incisors, anterior box elastics can be worn at night. However, stability of the corrected result is never guaranteed. Clinicians should assess the incisal show during their examination to see if such mechanics are suitable. 

REFERENCE

Bearn DR, Alharbi F (2015) British Orthodontic Society national audit of temporary anchorage devices (TADs): report of the first thousand TADs placed. *J Orthod* 42(3): 214-219

CONTACT



dr.nikhilgogna@hotmail.com



@dr.nik.orthodontist

PRODUCT RECOMMENDATIONS

Infinitas kit

The Infinitas kit from DB Orthodontics is my go-to TADs kit. It offers simplicity, predictability and a variety of kit types including the introduction, complete and stent guide kits.

Reverse Curve archwires

The super elastic nickel titanium Reverse Curve archwires (again from DB Orthodontics) offer a variety of choice. The reverse curves start as early as an 014 nickel titanium so overbite reduction or anterior open bite correction can begin immediately.

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SURVEY REVEALS PREFERRED METHOD FOR PROFESSIONAL PROPHYLAXIS
EMS

A clean mouth is not only crucial for oral health but also for overall health in general. That's why finding ways to remove microbial dental plaque (biofilm) effectively is key to patient wellbeing.

In a global survey of 76,000 patients to determine the preferred method for professional prophylaxis, 92% said they were enthusiastic about EMS's guided biofilm therapy (GBT) method and would recommend it to family and friends.

The questionnaires consisted of eight questions, including the overall assessment of GBT, the surface smoothness achieved, the usefulness of disclosure before starting the treatment and a direct comparison with the conventional method.

The anonymised questionnaires were provided to EMS by prevention-oriented practices and clinics.

GBT achieved very good results in all the questions illustrated, scoring 4.6 or 4.7 out of a possible five points in each case.

In addition, more than 98% of patients reported experiencing no unpleasant pain during treatment or that the pain was less than with conventional treatment.

On 16 September 2022, at the Royal College of Physicians, the GBT Summit in London will bring together leading international experts and clinicians to share information about preventive dentistry and modern therapies to support existing GBT users and support those looking for new ways to elevate their skillset.

dentistry.co.uk/shows/gbt-summit

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SDI has launched new Pola for Aligners, an innovative tooth whitening treatment suitable for any clear aligner system, allowing patients to brighten as they straighten their teeth.

Building on the success of an award-winning at-home whitening range, Pola for Aligners uses SDI's Pola Night gel with a formulation that delivers exceptional results without the chair time, and with minimal sensitivity.

Pola for Aligner's benefits include:

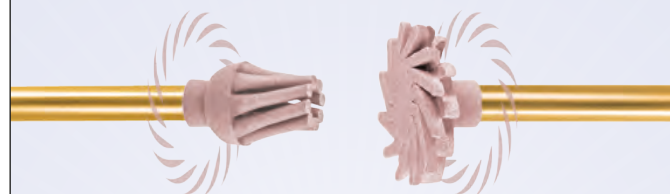
- An easy-to-use, four-syringe take-home kit prescribed by a dentist
- A versatile treatment safe for overnight wear, or for a couple of hours, between meals, depending on patient preference
- Great patient comfort thanks to a formulation with potassium nitrate and fluoride, making it ideal for long-term use
- A high viscosity gel that stays in place in the clear aligner tray
- Added 10% carbamide peroxide, an active recognised as the gold standard in tooth whitening for its optimal results and patient safety and comfort.

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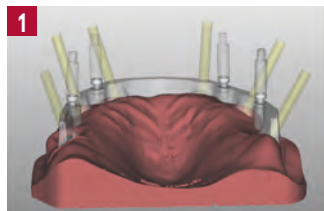
DOUBLE SCREW METAL TECHNIQUE Zirkonzahn

The Double Screw Metal is a special technique to produce aesthetic full arches on implants with a strong orientation towards the vestibular area. The technique consists in the integration of additional screws in the bar design: the bar is screwed to the implants and the superstructure to the bar, avoiding non-aesthetic vestibular channels especially in the anterior region.

The design software (Zirkonzahn. Modellier) is provided with a new function to perform the Double Screw Metal technique, where the user can visualise the screw positions and generate the screw threads within the bar design. Through 3D rendering, it is possible to identify the optimal position of the screw channel in the primary structure, as well as the ideal fit of the screw head in the superstructure. The digital screws are provided with several discs indicating the ideal insertion depth, to avoid any ruptures in the zirconia framework. The software function also permits the design of the channel thread, which is then milled with high precision using special burs in Zirkonzahn's M2 milling units. Thanks to the particularly stable double bearing suspension and the new, more powerful and compact spindle, the machines are fully vibration resistant.

The design of the titanium bar incorporates an innovative CAD/CAM workflow, in which additional screws are added to screw the superstructure to the bar (Figure 1). The titanium bar is screwed to the implants and the secondary structure is screwed to the bar (Figure 2). The integration of the Double Screw Metal technique avoids non-aesthetic vestibular channels, to produce highly stable, bar-supported rehabilitations even in complex cases without compromising the full arch aesthetics (Figure 3).

www.zirkonzahn.com



A PERFECT PARTNERSHIP Amann Girrbach

TRI Dental Implants has found the perfect partner for the realisation of the restorations in Amann Girrbach.

Amann Girrbach is a system provider of CAD/CAM solutions for the laboratory and dental practice, and provides its users with validated workflows offering maximum efficiency and safety. This also applied to the project with TRI Dental Implants: in addition to detailed process validation of software and machine, a number of different materials were also validated. For example, in future it will be possible to fabricate high-precision crowns from Zolid DRS or Zolid Gen-X directly on the implant without compromising either function or aesthetics. In combination with the Ceramill Therm DRS sintering furnace, the final result is available in just 20 minutes.

Falko Noack, vice president research and development at Amann Girrbach, comments: 'Close cooperation with TRI Dental Implants made perfect sense for us, as we have found a cooperation partner here who consistently pursues CAD/CAM philosophy in the field of implants, specifically with regard to the Matrix system. Due to the connection geometry developed specifically for CAM production, an excellent fit between implant and abutment can be created easily, reliably and, above all, extremely precisely. Creation of the milling tools and the geometry of the mating surface to the implant as well as to the screw connection could be ideally adapted to each other during development. This is why reproducibility of the results is also given, and this has been impressively confirmed in in-house and external test results.'

Both partners are enthusiastic about the cooperation and the achieved innovative development, as Sandro Venanzoni, chief technology officer at TRI Dental Implants, also points out: 'TRI Dental Implants has been working intensively on digital implant dentistry over the past years. In a rapidly changing market for dental implants, there is often talk of a "fully digital workflow", but in reality, numerous manual steps such as bonding and cementing are still required. With the Matrix concept, we now have a 100% CAD/CAM-compatible implant system and a digital workflow. The cooperation with Amann Girrbach was crucial and also extremely valuable for the development of Matrix.'



PERIODONTOLOGY AND IMPLANT DENTISTRY: PRESENT AND FUTURE

European Federation of Periodontology

Europerio10, the world's leading congress in periodontology and implant dentistry organised in Copenhagen on 15-18 June by the European Federation of Periodontology (EFP), was the most exciting Europerio yet.

Professor Phoebus Madianos, chair of Europerio10, said: 'Europerio attracts the best speakers, scientists, and clinicians from around the world to the Olympic Games of dental congresses. This is the main event organised by the EFP and the growing success of Europerio is mainly due to the scientific programme, which delivers the present and future in the science and practice of periodontology and implant dentistry.'

Research was presented on novel topics such as the role of artificial intelligence in the diagnosis

and treatment of periodontitis. New evidence was revealed on previously investigated areas including the links between gum disease and heart conditions, diabetes, premature birth and lung function, and the long-term outcome of periodontal treatment. Plus: the first European guideline on how to treat advanced (stage IV) periodontitis.

Professor Andreas Stavropoulos, EFP president, said: 'The EFP is the global benchmark in gum health and gum diseases. The main mission of the EFP is to raise awareness about the importance of gum disease and gum health, and our motto is periodontal health for a better life. This is what we communicate to society and to politicians so that we can influence decision making and improve oral health. Our main educational activity is Europerio, and this edition has attracted a very young audience, which clearly indicated the interest in periodontology of the young generation of colleagues.'

'We look forward to seeing the dental community at Europerio11 from 14 to 17 May 2025 in Vienna, Austria.'



GUIDELINE FOR TREATING STAGE IV PERIODONTITIS PUBLISHED

European Federation of Periodontology



The first European guideline for the treatment of advanced (stage IV) periodontitis has been published in the *Journal of Clinical Periodontology*.

Approximately 1.1 billion people worldwide had severe periodontitis (stages III and IV) in 2019, making it the most common chronic inflammatory non-communicable disease.

This guideline focuses on stage IV periodontitis, which is the most advanced stage. In addition to the inflammation and loose teeth in stage III, patients with advanced disease have some of the following: loss of five or more teeth due to periodontitis, teeth moving out of position, flaring ('buck') teeth, and difficulty in chewing.

Treatment aims to control inflammation and prevent further damage of the supporting tissues of the teeth, and to restore tooth function. Therapy begins with the recommendations for stages I to III periodontitis, as stated in the previous guideline published in 2020.

Additional treatments for stage IV disease can involve orthodontic therapy to straighten or move teeth, and construction of prostheses to replace missing teeth, either supported by teeth or by dental implants. Professor Herrera said: 'Extracting teeth to place dental implants is not a reasonable option if teeth can be retained.'

Professor Andreas Stavropoulos, EFP president, said: 'This guideline for stage IV periodontitis complements that for stages I to III, meaning that for the first time in history we now have European recommendations for the interdisciplinary and evidence-based management of all stages of this disease. Application of the guideline is expected to improve the quality of periodontal treatment in Europe and worldwide. The EFP will be working with national periodontology societies to translate and adapt the guideline to the local context.'

www.efp.org

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excellent aesthetic results for the Axiom bone level implants (Salina et al, 2019).

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GENERAL DENTISTRY CD/AUG/QURESHI/PAGE 14

- The case in the article highlights the treatment of a patient over how many years?
 - ☐ a. 12
 - ☐ b. 15
 - ☐ c. 17
 - ☐ d. 24
- Why did the patient initially present in 2004?
 - ☐ a. She was unhappy with her two discoloured upper central incisors
 - ☐ b. She had chipping and wear to the lower teeth
 - ☐ c. She had broken posterior bridgework
 - ☐ d. All of the above
- In 2017, what was the patient's main concern?
 - ☐ a. Improving the appearance of the upper central teeth
 - ☐ b. The tooth wear of the lower teeth
 - ☐ c. Replacing all the lower composites
 - ☐ d. None of the above
- What treatment did the patient decide to have in 2021?
 - ☐ a. Place veneers on the two upper centrals
 - ☐ b. Replace the two upper central units with a lithium disilicate crown/veneer
 - ☐ c. Replace the two upper centrals with composite
 - ☐ d. She opted against treatment at this stage

AESTHETIC DENTISTRY CD/AUG/MOOSAJEE/PAGE 25

- According to the author, colour is made up of:
 - ☐ a. Hue
 - ☐ b. Chroma
 - ☐ c. Value
 - ☐ d. All of the above
- When it comes to tooth whitening, which of the following patient groups may present as challenging cases?
 - ☐ a. Non-smokers
 - ☐ b. Older patients
 - ☐ c. Female patients
 - ☐ d. Male patients

3. At the author's practice, who carries out much of the tooth whitening treatment?

- ☐ a. Dentists
- ☐ b. Dental hygienists
- ☐ c. Dental therapists
- ☐ d. Dental nurses

4. Which of the following is the author's preferred tooth whitening system?

- ☐ a. Philips Zoom
- ☐ b. Boutique Whitening
- ☐ c. Opalescence
- ☐ d. Enlighten Whitening

DIGITAL DENTISTRY CD/AUG/YAVUZ/PAGE 37

1. What is the name of the software that the author and his research team are developing as an AI solution in dentistry?

- ☐ a. Craniocatch
- ☐ b. Periocatch
- ☐ c. Dentocatch
- ☐ d. None of the above

2. In the study, how many dental bitewing images, obtained from the Eskisehir Osmangazi University archive, were loaded into the labelling module?

- ☐ a. 232
- ☐ b. 343
- ☐ c. 434
- ☐ d. 532

3. What was labelled by an experienced specialist with the segmentation method?

- ☐ a. Horizontal and vertical bone losses
- ☐ b. Calculus
- ☐ c. Furcation defects
- ☐ d. All of the above

4. In the article, what does CNN stand for?

- ☐ a. Cable News Network
- ☐ b. Convolutional neural network
- ☐ c. Cellular neural network
- ☐ d. Cellular nonlinear network

ENDODONTICS CD/AUG/MACHTOU/PAGE 49

1. According to the authors, what does MIE stand for?

- ☐ a. Mandibular incisor extraction
- ☐ b. Minimally invasive endodontics
- ☐ c. Micro instrumentation endodontics
- ☐ d. Mine investigation and exploitation

2. What is the main drawback of larger apical preparations?

- ☐ a. The increased risk of creating adverse iatrogenic errors
- ☐ b. The bacterial increase
- ☐ c. The reduced apical periodontitis healing
- ☐ d. An increase in postoperative pain

3. In the Toronto study – phase four (de Chevigny et al, 2008), what was the healing rate of the Schilder shaping technique with warm vertical compaction of gutta percha compared to the standardised technique with lateral condensation?

- ☐ a. 86% versus 74%
- ☐ b. 68% versus 78%
- ☐ c. 87% versus 77%
- ☐ d. 78% versus 72%

4. When was Fatima et al's prospective randomised clinical trial assessing different preparation sizes combined with different apical tapers on the outcome of primary endodontic treatment released?

- ☐ a. January 2021
- ☐ b. April 2021
- ☐ c. June 2021
- ☐ d. September 2021

IMPLANT DENTISTRY CD/AUG/COWELL/PAGE 59

1. Implant complications are classified by the International Team for Implantology using all of the following terms except:

- ☐ a. Surgical
- ☐ b. Biological
- ☐ c. Patient-related
- ☐ d. Aesthetic

2. The authors suggest that, following surgery, all implant patients should have the following except:

- ☐ a. Access to an out of hours service
- ☐ b. Postoperative phone call
- ☐ c. An explanation of when full sensation is likely to return
- ☐ d. Antibiotics for every procedure

3. In order to describe peri-mucositis disease, the area has to involve:

- ☐ a. Bone loss around the neck of the implant
- ☐ b. Inflammation of the peri-implant mucosa
- ☐ c. Malposition of the dental implant
- ☐ d. Mobility of the implant

4. Which of the following reasons is not a cause for a loose screw connecting an implant retained crown?

- ☐ a. Occlusal overload
- ☐ b. Cloned components
- ☐ c. Wrong torque at fit
- ☐ d. Implants too close together

LABORATORY CD/AUG/ANTOSCH/PAGE 78

1. What do the authors claim should be agreed upon among all parties involved?

- ☐ a. Overall aesthetic result
- ☐ b. Timeframe
- ☐ c. Cost
- ☐ d. All of the above

2. Why is the test phase with temporary crowns considered a mandatory step by the author?

- ☐ a. It reduces the risk of errors in the final crowns
- ☐ b. It allows the patient to process the financial implications
- ☐ c. It increases patient compliance
- ☐ d. None of the above

3. During the finishing stage, transparent lithium silicate Cerafusion was sprayed onto the final crowns. Glaze firing followed at what temperature?

- ☐ a. 120°C
- ☐ b. 720°C
- ☐ c. 920°C
- ☐ d. 1120°C

4. What is an advantage of monolithic zirconia crowns?

- ☐ a. They are fabricated without porosity
- ☐ b. They are homogeneous compared to other ceramics
- ☐ c. They do not exhibit roughness if glazed properly
- ☐ d. All of the above

ORAL HEALTH CD/AUG/KRASTEV/PAGE 87

1. In 2008, the American Association of Endodontists (AAE) published guidance regarding diagnosis and treatment of a cracked tooth. What was the term 'cracked tooth' replaced by in this work?

- ☐ a. Longitudinal fracture
- ☐ b. Fractured cusp
- ☐ c. Vertical crack
- ☐ d. Split tooth

2. How many different types of longitudinal fracture did the AAE establish?

- ☐ a. Two
- ☐ b. Three
- ☐ c. Four
- ☐ d. Five

3. Which tooth was established as 'responsible for the problem' in case report one?

- ☐ a. UL8
- ☐ b. UR8
- ☐ c. UR6
- ☐ d. UL6

4. What's the most common bacteria responsible for caries and periodontal damage?

- ☐ a. Porphyromonas gingivalis
- ☐ b. Aggregatibacter actinomycetemcomitans
- ☐ c. Streptococcus mutans
- ☐ d. All of the above

ORTHODONTICS CD/AUG/AFZAL/PAGE 100

1. In this case, what did the orthodontic assessment include?

- ☐ a. Digital impressions
- ☐ b. Panoramic X-rays
- ☐ c. Clinical photographs
- ☐ d. All of the above

2. What did the patient score across the board for her basic periodontal examination?

- ☐ a. Zero
- ☐ b. One
- ☐ c. Two
- ☐ d. Three

3. How many refinement aligners were needed in this case?

- ☐ a. Three
- ☐ b. Four
- ☐ c. Five
- ☐ d. Six

4. What was provided for the chipped upper centrals?

- ☐ a. Composite edge bonding
- ☐ b. Veneers
- ☐ c. Crowns
- ☐ d. None of the above

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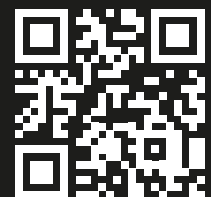


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