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Treating Tooth Wear: From Diagnosis to Practical Solutions

Tooth wear is becoming an increasingly common challenge in daily practice, affecting patients of all ages and an estimated four out of ten individuals with moderate to severe wear. As prevalence continues to rise, clinicians are seeking treatment approaches that are effective, predictable, and minimally invasive.

Successful management of tooth wear starts with accurate diagnosis and a clear understanding of the underlying causes. From there, clinicians must select treatment strategies that balance function, aesthetics, preservation of tooth structure, and long-term patient outcomes. This requires a structured approach, with carefully planned steps that lead toward a clear, well-defined goal.

This Get Connected special edition brings together a collection of clinical cases that demonstrate how dental professionals are managing tooth wear in real-world settings. From moderate cases treated with direct restorative techniques to more advanced and indirect rehabilitations, the featured cases highlight practical solutions that can be applied in everyday practice.

As part of GC's commitment to education and evidence-based dentistry, this publication aims to share clinical experience, inspire new ideas, and support confident decision-making. We hope these cases provide practical insights that help you deliver lasting solutions for patients affected by tooth wear.

Enjoy the cases and join us in advancing the management of tooth wear.

Managing Tooth Wear: Why Awareness and Pragmatism Matter

An interview with **Prof. Dr. Bas Loomans**, the Netherlands

Prof. Dr. Bas Loomans *obtained his PhD on the topic of restorative dentistry in 2007. In 2008 he was a visiting researcher at BIOMAT, KU Leuven, Belgium. In 2021, he was appointed full professor of Oral Function and Restorative Dentistry at the Radboud University Medical Center in Nijmegen, The Netherlands. He is involved in research, undergraduate and postgraduate education. His main research interests are the management and treatment of severe tooth wear, diagnostic criteria, development of smart dental materials, translational research, intra-oral censoring of gastric acid, and decision-making processes using artificial intelligence. He has become a nationally and internationally recognized expert in adhesive and restorative dentistry and is the project leader of the 'Radboud Tooth Wear Project'.*
Additionally, in 2019 he received the international Steve Bayne Mid-Career Award of the Dental Materials Group of the International Association of Dental Research. He has authored more than 120 international and national publications and is (co-)author and editor of several book chapters. In addition to his academic work, he is working one day a week in a general/referral dental practice in Nijmegen. His professional interests focus on reconstructive dentistry, with an emphasis on minimally invasive treatment approaches. ResearchID: B-2910-2016; ORCID: https://orcid.org/0000-0002-6684-9723

Tooth wear is an increasingly common challenge in modern dentistry, requiring thoughtful, patient-centered approaches. We spoke with Prof. Dr. Bas Loomans, a leading expert in the field, who shared his insights on managing wear through pragmatic management strategies, with a strong emphasis on diagnosis, prevention, minimally invasive care, cost-effectiveness, collaborative learning and patient education. His philosophy centers on empowering patients and dental professionals through awareness, helping them take ownership of their oral health while ensuring treatments remain accessible and sustainable.

To begin with, based on your experience and expertise over the past 30 years, could you give us an overview of what we currently know about tooth wear, and how our understanding of it has evolved?

Over the past few decades, our understanding of tooth wear has evolved significantly. While it may seem that the prevalence of moderate to severe tooth wear is increasing, we should be cautious with that assumption. What has truly changed is the level of awareness among dental professionals.

Dentists today are better trained to recognize early signs of wear and understand its implications, whereas in the past, wear was often noticed but not managed until it became a serious issue.

Another major change is in treatment philosophy. Previously, invasive procedures like full crowns were common, even for young patients. But now, thanks to research and clinical experience, we know that minimally invasive approaches–especially using composites–can be effective, even in severe cases. This shift reflects a broader move toward more pragmatic, patient-friendly care that preserves tooth structure and adapts to the needs of younger patients.

In your opinion, what are the most important causative factors of tooth wear?

Fifteen years ago, I believed mechanical factors–like grinding, clenching, or biting on objects–were the main causes of tooth wear. And in prevention, we were also mainly focusing on these factors, often prescribing nightguards. But over time, and especially through data from our long-term monitoring group from the Radboud Tooth Wear Project, it's become clear that chemical factors play a much more significant role than originally anticipated.

Tooth wear is influenced by both mechanical and chemical processes, each with intrinsic and extrinsic sources. Intrinsic mechanical factors include clenching and grinding, while extrinsic ones involve habits like biting pens or nails. On the chemical side, intrinsic factors include reflux or vomiting, and extrinsic ones are linked to acidic foods and beverages.

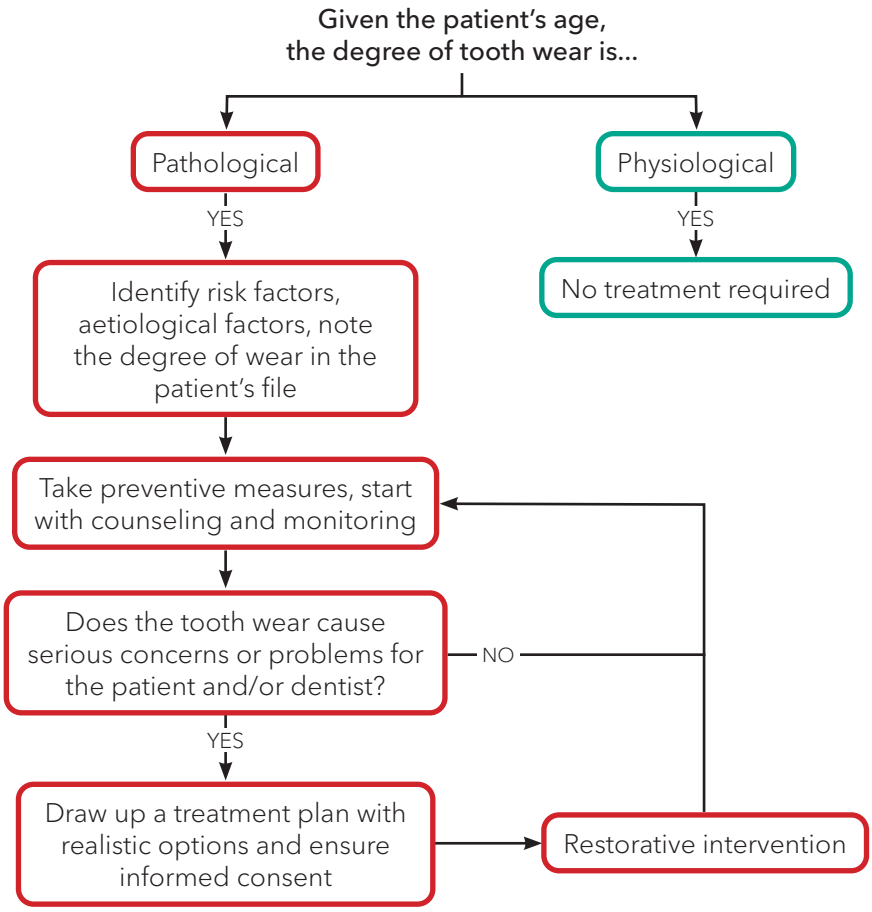

Fig. 1: Flowchart for treatment options for tooth wear. European Tooth Wear Consensus Meeting, 27th of October, 2016

What we now understand is that mechanical forces alone rarely cause severe wear. Acid exposure – whether from internal or external sources –softens the tooth surface, making it far more vulnerable to mechanical wear. So, in most cases, acid is a necessary component in the wear process. The combination of chemical softening and mechanical stress leads to the patterns we observe clinically.

If we shift the perspective from dentists to patients, would you say that patients themselves are generally aware of their tooth wear, or is it usually the dentist who identifies and communicates it?

In general, most patients are not very aware of their tooth wear. In our experience, many are referred to our clinic by their dentist and often say they don't really know why–they were simply told to come. This shows that the demand for treatment often doesn't come from the patient, but from the dentist's observation.

That said, when wear becomes extreme or starts affecting aesthetics – like discoloration or visible damage – some patients do begin to raise concerns themselves. Sensitivity can also be a trigger, but interestingly, the severity of wear is not always linked to pain. In fact, patients with less wear sometimes report more pain, especially when acid erosion is involved and dentinal tubules are exposed.

Ultimately, one of the most important roles of the dentist is to create awareness. It starts with recognizing the signs of wear and then explaining them to the patient – what they see, what it might mean, and what could be causing it. Without that awareness, patients are unlikely to fully understand or accept the need for monitoring or treatment and are less likely to comply. So education and communication, both undergraduate and postgraduate, are key.

And how do you determine when to simply monitor tooth wear and when to begin restorative treatment?

Restorative treatment is not always necessary when tooth wear is present **(Fig. 1)** –even in cases that appear severe at first glance. If there's no pain, no aesthetic concern, and no clear demand for treatment from the patient, the recommended approach is to start with monitoring. This is also reflected in the European

Consensus Statement and the new Dutch guidelines on tooth wear diagnostics and management.[1,2]

Monitoring allows us to assess the progression over time **(Fig. 2)**. Surprisingly, many cases that look extreme remain stable for years–even up to a decade.[3] If wear progresses slowly and the patient is comfortable, there's no need to intervene. However, if the patient experiences pain, aesthetic dissatisfaction, or functional issues, then treatment becomes necessary.

Patient involvement is key. When patients understand the condition and its implications, they're more likely to engage with the treatment process and accept its limitations.

How do you implement preventive strategies?

It's rarely possible to pinpoint a single cause of wear, so I avoid taking an overly authoritative approach. Instead, I focus on helping patients understand the potential contributing factors and encouraging reflection on their own habits. I don't know what happens in their daily routines at home, but by drawing attention to certain behaviors – like diet, brushing technique, or parafunctional habits – patients often begin to recognize patterns themselves. When they understand why something matters, they're far more likely to take ownership and make meaningful changes.

So my approach is to inform, advise, and give space. Let the information sink in, allow the patient to think about it, and support them in taking responsibility for their own oral health. That's where true prevention begins – not just with instructions, but with insight and empowerment.

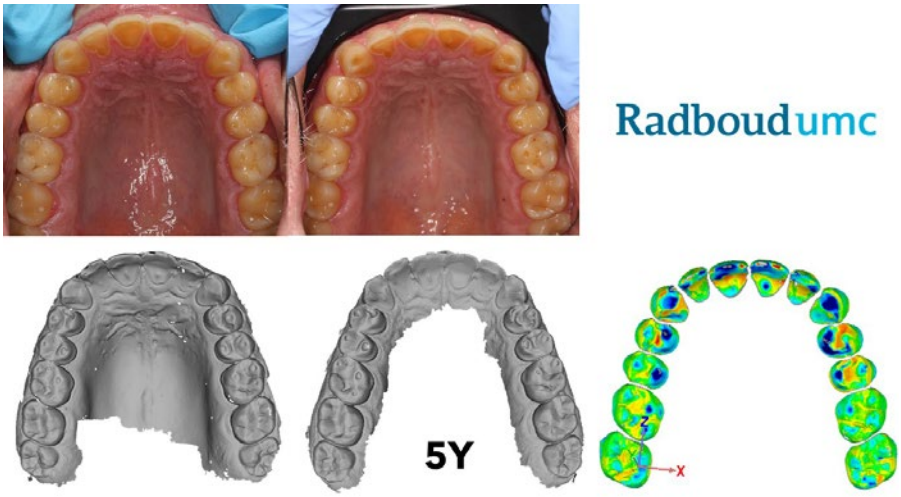

Fig. 2: Monitoring using digital scans. Subtraction of both scans indicates the progression of wear. Green shows no relevant differences, and blue areas represent locations of wear.

How do you approach material selection when restorative treatment is needed?

When restorative treatment is needed, I prioritize minimally invasive solutions – often starting with direct composite restorations. These can be highly effective when applied with the right protocol, and they offer the dual advantage of being the least invasive and the most cost-effective option.
I usually use hybrid composites, but if the main causative factor is chemical erosion, injectable composite might also work **(Fig. 3)**. And it needs to be kept in mind that composites require sufficient thickness to maintain their mechanical strength.

For me, tooth survival is more important than restoration survival, especially considering that many of our patients are relatively young. No restoration lasts forever – not even indirect ones – so preserving as much natural tooth structure as possible is key. That also implies thinking ahead: anticipating what might follow. What options will remain after this procedure?

We recently published a systematic review[2] comparing direct and indirect restorative options for managing tooth wear. While indirect restorations showed lower failure rates, they tend to be more invasive and require more operator time. Moreover, when failure does occur, repairs are often simpler and more conservative when composites have been used.

Ultimately, I aim for pragmatic solutions that serve the majority of patients. Given the relatively young age of our patient population, cost is a significant factor, and it cannot be ignored. That's why direct composite restorations often become the preferred choice – they strike a balance between clinical success, patient accessibility, and long-term maintainability.

How important is it to restore a correct occlusion?

There are two schools of thought – the "occlusionists" who believe everything stems from occlusion, and the more pragmatic view, which I follow. While occlusal support is important, there's no strong evidence that achieving textbook-perfect contacts, like cusp-fossa or canine guidance, leads to better outcomes or fewer failures.

Fig. 3: Restorative treatment with direct composite (injection moulding technique)

Instead, I aim for functional and stable occlusion, avoiding contact on weak areas like marginal ridges. If canine guidance is achievable, that's fine – but if not, group guidance works just as well. Ultimately, teeth aren't always perfectly aligned, and restorations should adapt to the patient's reality, not an idealized model. A successful treatment lies not in achieving perfection, but in understanding and respecting the patient's needs and meeting those.

This has been an enlightening discussion on the nuances of occlusion and tooth wear. Thank you for your time and expertise.

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The Dahl concept: Practical aspects through a 5-year follow-up

By **Dr Kostas Karagiannopoulos,** United Kingdom

Dr Kostas Karagiannopoulos, *BDS MClinDent, is an experienced specialist prosthodontist, an academic and a researcher. He has been involved in academia since 2008 and is now a Clinical Lecturer at University College London. He leads Bio-Emulation in the UK, an international group of dentists united by the drive to preserve and restore dental tissues using nature as a guide. He co-founded Prosthoworks delivering advanced private prosthodontic education since 2021. His areas of interests are fully guided composites, managing the worn dentition and naturally looking prostheses. He also works in specialist practice limited to Prosthodontics in the London area.*

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The Dahl concept in restoring teeth with tooth wear has been extensively used for around 50 years primarily in North Europe. While it may not enjoy global recognition, this approach can serve as a minimally invasive and cost-effective alternative to more extensive dental procedures when applied in an appropriate clinical context. It involves restoring only the affected teeth in localised tooth wear cases, sparing the ones that do not require restorations. It is conceptually an orthodontic modality, firstly described as 'Relative axial tooth movement' by Krogstad and Dahl in 1975.[1-4]

The common denominator in almost all wear cases is lack of restorative space. Dento-alveolar compensation condemns opposing teeth and alveoli to migrate towards each other as the teeth are worn away. This means that worn teeth in occlusion are in the wrong position. For localised tooth wear cases, the options for creating this restorative space and allowing to add the lost volume back on the worn teeth are the following:
- Orthodontic intrusion of the worn teeth followed by additive restorations at the same occlusion
- Increase the occlusal vertical dimension and restore all the teeth in the arch (irrespective of whether they are worn or not)
- Increase the vertical dimension and restore only the worn teeth sparing the ones not affected by wear

Within an average timeframe of 2 to 9 months, a new occlusion is generally established subsequent to the modifications detailed below **(Fig. 1)**:
- Intrusion of the restored teeth
- Supra-eruption of unrestored teeth
- Mandibular repositioning as the anterior composites act as a permanent deprogrammer seating the condyles in centric relation

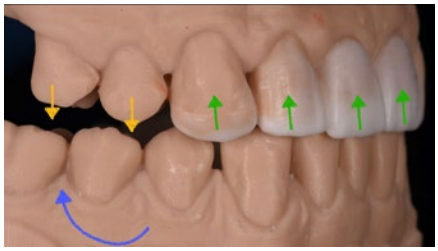

Fig. 1: A diagnostic waxup showing the dynamics of the Dahl concept. The indication for utilising the Dahl concept is localised tooth wear with evidence of dentoalveolar compensation. The contraindications are listed in Table 1.

Contraindications for the Dahl concept and explanations
Generalised tooth wear would require full arch/full mouth restorations
Crowding would benefit from pre-restorative orthodontics
Anterior/posterior open bite shows lack of eruptive potential
Implant prostheses will not exhibit any supra-eruption
Failing posterior restorations lean towards full arch restorations
Periodontal disease, multiple missing teeth, tilted molars and a deep overbite are less predictable to manage with the Dahl concept

Table 1: Contraindications for the Dahl concept

Case report

A 45-year-old man was referred due to significant wear on his anterior teeth. The patient was not interested in comprehensive care (including orthodontics) and was only concerned about the deterioration of his upper anterior teeth. The worn teeth were all in occlusion and there was clear lack of restorative space **(Fig. 2).**

Fig. 2: Pre-operative photos with drawings of ideal tooth positions

The agreed plan was to restore the six upper anterior teeth with bonded additive composite restorations at an increased vertical dimension using the Dahl concept. Intra-oral scans, interocclusal records and clinical photographs were taken to aid the fabrication of an additive diagnostic waxup **(Fig. 3)**.

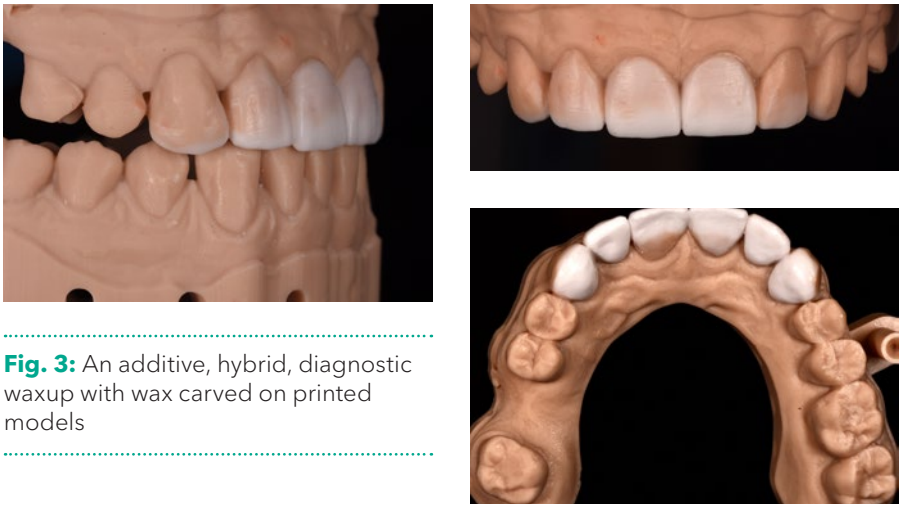

Fig. 3: An additive, hybrid, diagnostic waxup with wax carved on printed models

An additive restorative approach is usually indicated in tooth wear cases and allows for the verification of aesthetics, occlusal changes, patient comfort and phonetics through the process of a mockup intra-orally using a dual-cure composite (TEMPSMART DC, GC) **(Fig. 4).** Moreover, additive dentistry is preferred by patients who sometimes object to tooth preparation required for indirect restorations.

Fig. 4: Diagnostic mockup of teeth 13-23

The injection moulding technique was utilised to restore the six worn anterior teeth thus utilising the advantage of excellent replication of a pre-approved morphology and occlusion. A crystal-clear, pressurised silicone stent (EXACLEAR, GC) was made from the waxup. Rubber dam isolation was applied, air particle abrasion with 29-micron alumina was used followed by placing PTFE tape based on the alternate tooth technique **(Fig. 5)**. The injection moulding technique was applied with a universal, one-bottle adhesive (G-Premio BOND, GC) and a highly filled flowable restorative composite (G-ænial Universal Injectable, Shade A2, GC).

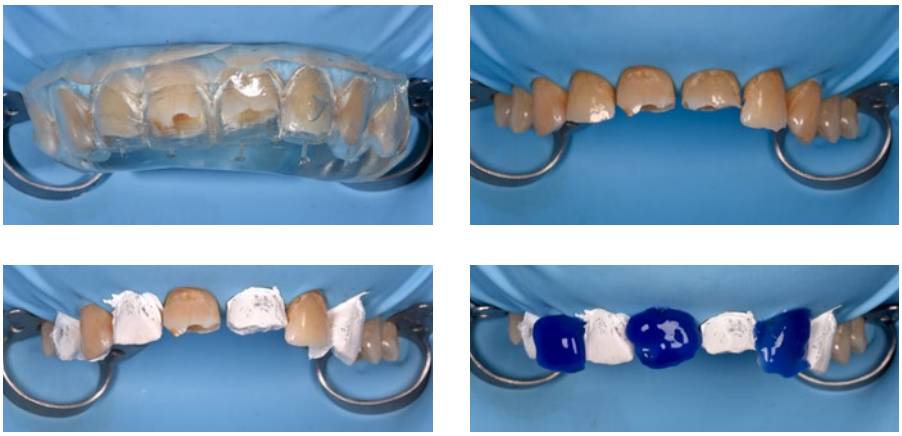

Fig. 5: Preparation for the injection moulding technique

All composite restorations were monoshade and were finished with metal proximal strips (New Metal Strip, GC) and n°12 blades. Polishing was completed with silicone spirals. On the day of treatment, the 'opening' of the posterior teeth was observed while all anterior teeth had even occlusal contacts as planned **(Fig. 6)**.

Fig. 6: Immediate post-operative photographs

The patient was reviewed every two months and the occlusion was monitored with articulating paper. After 8 months, the occlusion was fully re-established with all posterior teeth occluding **(Figure 7)**. At this point an occlusal appliance was fitted.

Fig. 7: Re-established occlusal contacts at 8 months

Despite feeling an initially awkward occlusion, the patient reported no pain and he could eat normally again within the first month even though the posterior teeth were not occluding. Occlusal re-establishment typically follows a sequence starting with the second molars, then the first molars, and finally the premolars. The new contacts on the posterior teeth show variation, as some are on cusp inclines, some on cusp tips and some on marginal ridges. Restoration fractures are rarely observed during the Dahl phase, as the anterior composites tend to reduce muscle activity through their deprogramming effect. Moreover, no patient discomfort /pain or tooth mobility/drifting was observed during the Dahl phase. The patient discussion and consenting process is illustrated in **Table 2**.

The patient was followed up for five years with minimal maintenance **(Figure 8)**. The material properties of G-ænial Universal Injectable – such as high flexural strength and wear resistance – support long-term stability.[5]

Patient discussion and Consent
The worn teeth are restored, separating the ones do not need treatment The treatment will change your bite and on the day of the mockup, the changes are tested The new bite does not hurt and you will get used to it after 3-4 weeks Gradually, the back teeth will drift towards each other over a 2-9 month period In 5% of cases, this movement is not observed, indicating that restoration may be required Once the bite is fully established, a mouth guard will be provided

Table 2: Patient discussion

Fig. 8: 5-year Dahl follow-up

The gold standard for managing a case of anterior localised tooth wear would involve comprehensive orthodontics, followed by additive restorative dentistry on the teeth affected by tooth wear.[6-8] The purpose of this article is to clarify that increasing the occlusal vertical dimension is not synonymous with restoring the entire arch solely for prosthetic convenience. An alternative to a full arch reconstruction is the Dahl concept, an orthodontic modality that spares the unworn teeth from restorative treatment. The use of injectable composite allows for minimally invasive restoration without preparation, preserving healthy tooth structure. While the technique may involve several follow-ups and an uncertain final occlusal outcome, it offers a practical and cost-effective solution for treating localised tooth wear in a general dental setting.

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Prof. Dr. Marleen Peumans *obtained her degree in Dentistry in 1987 at the Catholic University of Leuven. Thereafter, she followed a 4-year post-graduate program at the Department of Operative Dentistry. She applied herself, especially to the clinical use and the performance of anterior and posterior resin composites, bonded ceramic restorations, fiber-reinforced composite restorations, and bleaching. She took part in numerous clinical studies concerning dentine adhesives, posterior composites, and ceramic veneers/inlays/onlays. In 1997 she obtained the degree of Doctor in Medical Sciences. From 2004 she became Professor at the Catholic University of Leuven. She has several national and international publications on her name concerning clinical performance of adhesive restorations and bleaching. She is a member of the Bio-Emulation team and the GC Restorative Board.*

Minimal invasive rehabilitation of generalized tooth wear using a conventional composite and the stamp technique.

By **Prof. Dr. Marleen Peumans,** Belgium

Generalized tooth wear is a common clinical condition that can significantly impact dental function, aesthetics, and patient comfort. It often presents as a gradual loss of tooth structure across multiple surfaces, requiring careful assessment and a tailored restorative strategy.[1] Successful management involves restoring lost anatomy, reestablishing occlusal harmony, and preserving remaining tooth structure – all while meeting the patient's functional and aesthetic expectations.

Direct composite restorations offer a minimally invasive solution for managing tooth wear, with the added benefit of reversibility and cost-effectiveness. Traditionally, freehand techniques have been used, which allow for artistic flexibility and adaptability. However, they rely heavily on the clinician's skill and experience, which can introduce variability in outcomes.

Guided techniques – such as those using silicone matrices, wax-ups, or digital mock-ups – provide a structured and predictable framework for composite placement. These methods are especially valuable in posterior restorations and in re-establishing occlusal vertical dimension, where precision and repeatability are critical.

This case report describes the full-mouth rehabilitation of a 42-year-old female patient suffering from generalized severe tooth wear due to chronic bruxism **(Fig. 1)**. The patient was referred by her general dentist with the primary complaint of fractured incisal edges on her upper anterior teeth and a desire to improve her smile aesthetics. The treatment plan involved restoring both function and aesthetics through a carefully staged

Fig. 1: Extraoral view before treatment.

approachusing direct composite restorations and digital planning tools.

Initial Assessment and Diagnosis

Upon clinical examination, the patient presented with extensive wear across the dentition, most notably on the anterior teeth **(Figs. 2-4)**. The wear pattern was consistent with attrition[2], and the patient confirmed a long-standing habit of bruxism. She had been wearing a night guard for several years, indicating awareness and management of her parafunctional behaviour.

In the lower jaw, agenesis of one central incisor was noted, and several posterior teeth exhibited fractured cusps. The severity of wear necessitated a comprehensive approach to restore both the vertical dimension of occlusion (VDO) and the structural integrity of the teeth.
An orthodontic treatment was indicated to make space for the missing lower incisor, resulting in an ideal overbite. In the present situation, the contact points with the lower anterior teeth were positioned at the cervical third of the upper anterior teeth.

Digital Planning and Bite Registration

Digital impressions of the upper and lower arches were taken to facilitate precise planning. The bite registration was performed in (a so-called) centric relation using a composite anterior jig **(Fig. 5)**. This jig allowed for deprogramming of the masticatory muscles and guided the mandible into a passively retruded position.[3] The vertical dimension of occlusion was increased using this jig, with the final VDO determined by the restorative space required to rebuild the worn dentition.

Fig. 5: The bite registration was done was done in (a so-called) centric relation using an anterior composite jig.

Fig. 2: Intraoral view before treatment, showing signs of generalized severe tooth wear.

Fig. 3: Intraoral view in maximal occlusion.

Fig. 4a: Occlusal view of the upper jaw.

Fig. 4b: View of the lower jaw.

The dental technician created a digital wax-up of the upper and lower anterior teeth at the newly established VDO **(Fig. 6a-b)**. This wax-up was reviewed and approved using a digital viewer **(Fig. 6c-d)**, after which 3D-printed models were fabricated to guide the mock-up and restorative phases.

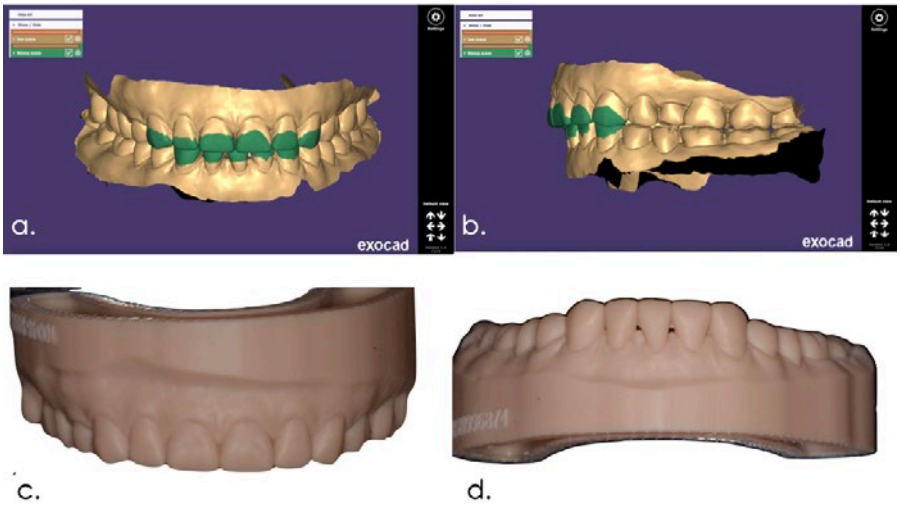

Fig. 6: a and **b:** Digital wax-up of the upper and lower anterior teeth in the desired vertical dimension of occlusion.
c and **d**: After approval of the digital wax-up on the viewer, 3D printed models were made of the upper and lower jaw.composite jig.

Fig. 7: Mock-up from a dual-cure bisacrylic composite resin (Tempsmart DC, GC).

Fig. 8: Mock-up of the upper anterior teeth. Instructions were given to the dental technician to make the upper central incisors slightly longer (dotted white line).

Fig. 9: Isolation of the lower anterior teeth with the palato-incisal silicone key in position.

Fig. 10: The palatal enamel walls of the lower anterior teeth built up with Essentia DE.

A clear interproximal delineation between the different teeth is important to avoid the composite walls sticking together.

Mock-Up and Aesthetic Evaluation

A hard silicone key was fabricated based on the 3D-printed model, and a mock-up of the anterior teeth **(Fig. 7)** was made using a dual-cure, bisacrylic composite (Tempsmart DC, GC). This step allowed both the clinician and the patient to visualize the proposed changes in tooth length, incisal line, and overall smile aesthetics. Following evaluation, minor adjustments were requested, including a slight increase in the length of the upper central incisors, which was communicated to the dental technician **(Fig. 8)**.

Restoration of the Anterior Teeth

The lower anterior teeth were restored first using the partial stamp technique in combination with direct composite layering. Shade selection was done chairside by applying Essentia Medium Dentin (MD) and Essentia Dark Enamel (DE) to one incisor, yielding a satisfactory aesthetic result.

Fig. 11: Result after restoring the lower incisors with Essentia MD and DE.

Fig. 12: A rigid palato-incisal silicone key, made on the 3D printed model and adjusted with EXACLEAR (GC) to enable polymerization through the key at the palatal side.

The lower anterior sextant was isolated with rubber dam, and the palato-incisal silicone key was tested for fit **(Fig. 9)**. No dental preparation was done, except for smoothing sharp enamel margins with a microfine diamond bur and sandblasting of the bonding surfaces with 50 µm alumina powder at a pressure of 4 bar to clean the tooth and remove amorphous enamel, exposing the prismatic structure for improved adhesion.[4]

The palatal enamel walls were built up using Essentia DE with the aid of the silicone key **(Fig. 10)**. The dentin was restored with Essentia MD, and the teeth were completed with a buccal enamel layer using Essentia DE. The restorations were refined and completed using a microfine pointed diamond bur, polishing rubbers, composite finishing discs, metal strips and composite finishing strips to achieve a natural appearance and smooth surface **(Fig. 11)**.

In the subsequent session, the upper anterior teeth were restored using the partial stamp technique. A rigid palato-incisal silicone key was fabricated and modified with a clear silicone (EXACLEAR, GC) to allow light transmission during polymerization **(Fig. 12)**. It ensures that the new contours follow the planned occlusal scheme, recreating the palatal anatomy needed for proper guidance during movements.

Fig. 13: The fit of the palato-incisal silicone key made is checked.

Fig. 14: Upper anterior teeth after air abrasion of the bonding surfaces. Note the small Class-3 cavities on both centrals because of caries lesions.

Fig. 15: After build-up of the palatal enamel wall of all upper anteriors using Essentia DE.

Fig. 16: Restored upper and lower anterior teeth.

After confirming the fit of the key **(Fig. 13)**, tooth preparation was carried out by removing sharp enamel margins and air abrading adjacent enamel surfaces. Small Class III cavities were prepared on both central incisors due to carious lesions **(Fig. 14)**.

The palatal enamel wall was built using Essentia DE and the silicone key (partial stamp technique) **(Fig. 15)**. The rest of the teeth was built up using a freehand technique. Teeth were separated with clear Mylar strips, and wedges were used in interproximal spaces where needed.

Fig. 17: Occlusal contacts after restoring the anterior teeth.

The dentin was restored with Essentia MD, followed by buccal enamel layering with Essentia DE. The restorations were finished and polished to match the lower anterior teeth and establish a harmonious anterior guidance **(Fig. 16)**. After restoration, occlusal contacts were evenly distributed across the anterior dentition **(Fig. 17)**.

Posterior Restorations and Occlusal Rehabilitation

Following the anterior restorations, the new vertical dimension of occlusion was fixed, with initial contact limited to the anterior teeth. A digital scan of the upper and lower arches at the new VDO was taken and sent to the dental technician for wax-up of the premolars and molars.

The wax-up was designed to replicate the anatomy of the planned direct composite restorations, with careful attention to the delineation of occlusal marginal ridges. The wax-up excluded the second molars, which served as reference points for repositioning the silicone keys during restoration, together with the restored canines **(Fig. 18)**.

Hard silicone keys were made and the occlusal area of the teeth to be restored was cut out and relined with EXACLEAR. These were used to transfer the wax-up to the patient's mouth **(Fig. 19)**. An alternative and more precise way to make a transparent rigid key is to rebase a vacuum-formed impression tray (hard resin plate with a thickness of 2 mm) with EXACLEAR. This tray is cut 1.5-2mm further than the margins of the worn teeth and sandblasted prior to the rebasing **(Fig. 20)**.

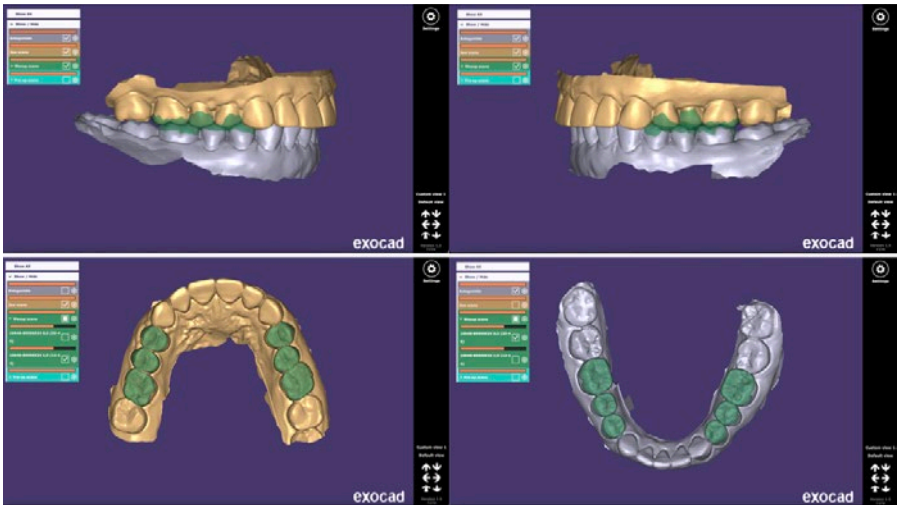

Fig. 18: Digital wax-up of premolars and molars, excluding the second premolar that was kept as a reference point.

Fig. 19: Hard silicone keys relined with Exaclear (GC) used to transfer the morphology of the 3D-printed model into the mouth of the patient.

Restoration began with teeth 24 and 26 **(Fig. 21)**, followed by tooth 25. Neighbouring teeth were protected with metal strips during etching with phosphoric acid, rinsing and subsequent adhesive application (G2-BOND Universal, GC). After the adhesive protocol these were replaced with Teflon tape and small wads of Teflon to prevent composite overflow into the cervico-interproximal embrasures.

The silicone key was filled with Essentia DE, positioned in the corresponding quadrant and pressed with gentle pressure until the key fitted the second premolars and canines.

During placement of the silicone key, excess composite material extruded cervically and interproximally and was subsequently removed. This process was repeated until the key

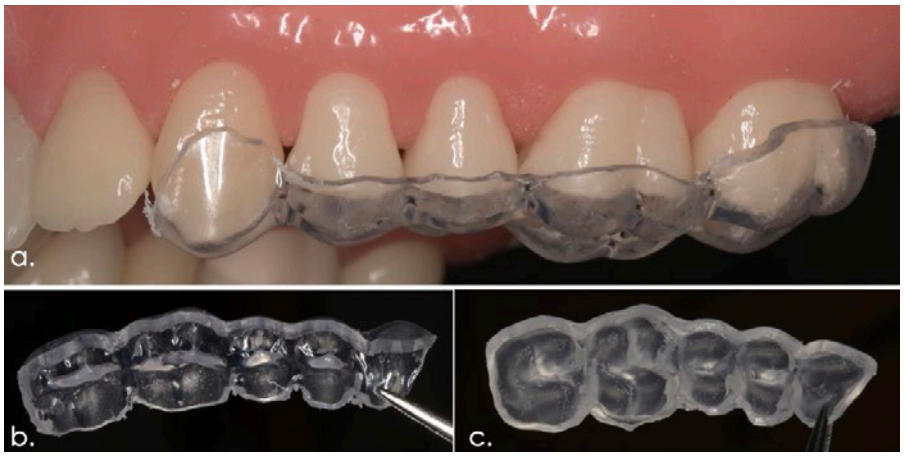

Fig. 20: Alternative stamp technique with vacuum-formed impression tray (2mm thickness) relined with EXACLEAR.

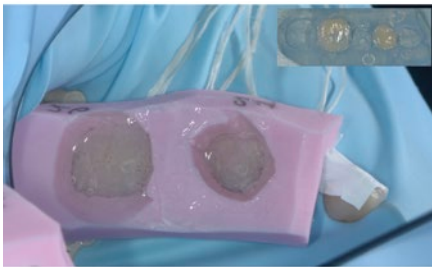

Fig. 21: The keys were filled with composite resin (Essentia DE) and seated.

was fully seated. Light-curing was applied to each tooth through the EXACLEAR for 40 seconds, followed by a second curing phase after removal of the key **(Fig. 22)**. The excess cured composite that ran over the occlusal surface of the neighbouring teeth was removed with a scalpel (n°12) **(Fig. 23)**. After interproximal finishing, tooth 25 was restored using the same protocol; tooth 27 was built up with free-hand modellation.

The primary excess composite on the palatal and buccal surfaces was removed using a microfine pointed diamond bur (FG) under water cooling. Buccal margins were further adjusted with a rubber polishing point (Brownie, FG, Shofu) operated at medium speed and low pressure, also with water cooling. Interproximal finishing was performed using a composite polishing disc and a metal finishing strip (GC metal strip – green band) to ensure smooth transitions and optimal contour.

Fig. 22: After removal of the silicone key, each restored tooth was light-cured for an additional 20 seconds. Excess cured composite extending onto adjacent teeth was carefully trimmed.

Fig. 23: After finishing composite restorations on teeth 26 and 24 and before restoring tooth 25.

Fig. 24: Second quadrant before (top) and after (bottom) treatment. The second upper molar (tooth 27) was restored using a freehand technique.

Fig. 25: Third quadrant before (top) and after (bottom) treatment

Fig. 26: First quadrant before (top) and after (bottom) treatment

Fig. 27: Fourth quadrant before (top) and after (bottom) treatment

Final polishing was completed with Identoflex composite polishers (Kerr) and a nylon brush to enhance gloss **(Fig. 24)**.

The same restorative protocol was applied to quadrant 3, including composite build-ups on teeth 34 and 36 using the silicone key **(Fig. 25)**. The second and third molars were restored using freehand modelling techniques. The first and fourth quadrant were restored in the same manner in the following session **(Figs. 26-27)**.

After final finishing and polishing, the restorations exhibited excellent anatomical form and surface texture. The old Class V restorations on the upper premolars and molars were noted for future replacement.

The final result revealed a well-balanced smile with a pleasing incisal line and restored function **(Figs. 28-30)**. The patient expressed satisfaction with both the aesthetic and functional outcomes.

Fig. 28: Result after final finishing and polishing. The old Class-5 composite restorations on the upper premolars/ molars still need to be replaced.

Fig. 29: Final result. The smile shows a nice incisal line.

Three years post-treatment, the restorations demonstrate stable clinical performance with no signs of failure. The overall condition of the restorations remains satisfactory, indicating good long-term durability. Minor wear could be seen on the composite surfaces, which is consistent with normal functional use over time **(Figs. 31-33)**.

Conclusion

This case demonstrates the effectiveness of a digitally guided, minimally invasive approach to full-mouth rehabilitation in a patient with severe tooth wear due to bruxism. Through careful planning, mock-up evaluation, and precise execution of the direct composite restorations using the stamp technique, both aesthetic and functional goals were successfully achieved.

A structured treatment protocol consisting of eight sessions ensured predictability and efficiency:

1. Pre-operative documentation: intra-oral and extra-oral photographs, digital scan, and bite registration.
2. Mock-up placement on anterior teeth for functional and aesthetic preview.
3. Direct composite restorations of the lower anterior teeth using the partial stamp technique.
4. Restoration of upper anterior teeth (using the partial stamp technique) followed by digital scans.
5. Posterior restorations in quadrants 2 and 3 using the stamp technique.
6. Posterior restorations in quadrants 1 and 4 using the stamp technique.
7. Final finishing and polishing.
8. Fabrication of a protective bite appliance.

Fig. 30: Final result: occlusal view of the restored upper jaw

Fig. 31: Final result: occlusal view of the restored lower jaw

Fig. 32: Follow-up after 3 years- occlusal view upper jaw. Slight wear of the composite restorations can be noticed.

Fig. 33: Follow-up after 3 years - occlusal view lower jaw.

To maintain the accuracy of the digital wax-up, it is crucial that the time between anterior and posterior build-ups does not exceed two weeks, preventing unwanted eruption of posterior teeth that could compromise the occlusal scheme.[5]
The digital wax-up, 3D-printed models, and customized transparent silicone keys played a pivotal role in transferring the planned morphology into the mouth with high fidelity. A well-defined interproximal delineation between teeth is essential to avoid composite bridging and to facilitate clean removal of excess material during posterior build-ups.

Moreover, successful use of a silicone key and conventional hybrid composite for posterior restorations depends on prior management of interproximal caries and replacement of old or inadequate restorations. This ensures optimal adaptation and longevity of the restorations.

Although the choice of optimal material for restoring severe tooth wear remains a topic of ongoing debate, there is increasing evidence supporting the successful use of composite resins for rehabilitating worn dentitions, both anterior and posterior. In this case, direct resin composite was chosen for its simplicity, affordability, and proven functional and aesthetic outcomes. Given its acceptable survival rates and ease of repair, it should be considered a first-line treatment for moderate to severe wear, with indirect options reserved for recurring or major failures. Minimally invasive techniques allow clinicians to refine occlusion while preserving healthy tooth structure, keeping future restorative options open - if ever needed.[6,7]

Overall, this case highlights how digital tools, strategic sequencing, and attention to clinical detail can elevate the quality and predictability of full-mouth rehabilitation in complex wear cases.

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A multidisciplinary hybrid strategy in the treatment of tooth wear

By **Dent. Michaël Van Styvendael**, Belgium

Tooth wear is increasingly being diagnosed in the dental practice. The process is typically multifactorial and the result of a combination of erosion, abrasion and attrition.[1] Dietary habits, lifestyle and parafunctional activity play an important role in this.

The treatment of tooth wear requires careful clinical assessment and depends on multiple factors, including the degree of wear, the presence of complaints and the patient's expectations. An essential distinction must be made between physiological and pathological tooth wear.[2,3] Physiological wear mainly requires preventive measures and monitoring over time. However, pathological wear can cause complaints such as dentine sensitivity, pain, aesthetic discomfort, loss of function or a reduced vertical occlusal dimension. In these cases, a more extensive and often multidisciplinary treatment is indicated. When restorative intervention is required, a minimally invasive and well-thought-out approach is preferable, focusing on functionality, aesthetics and sustainability.

The 46-year-old man described in this case report was initially referred because of repeated adhesive and cohesive fractures of a composite restoration on tooth 31 **(Fig. 1)**. Examination and anamnesis pointed to the need for a more comprehensive approach. In addition to functional complaints, the patient expressed aesthetic discomfort due to worn teeth and fractures in the composite restorations, consistent with pathological tooth wear **(Figs. 2-3)**. To obtain an objective grading of tooth wear, the Tooth

Fig. 1: Radiography showing why composite restoration 31 continued to fail repeatedly

Fig. 2: Initial situation in maximal occlusion

Fig. 3: Initial situation, slightly opened

	Sextant 1	Sextant 2	Sextant 3
Occlusal/Incisal	1	2	1
Palatal		1	
Occlusal/Incisal	1	2	1
	Sextant 6	**Sextant 5**	**Sextant 4**

Table 1. Quantitative Analysis of Wear according to the TWES (Tooth Wear Evaluation Scale) 2.0.[4] Score 0: no wear; 1: wear in enamel; 2: wear in dentine and loss of crown height <1/3; 3: loss of crown height between 1/3 and 2/3rd and 4: loss of crown height more than 2/3rd.

Wear Evaluation System (TWES 2.0) was used.[4] This system includes both quantitative and qualitative criteria for diagnosis **(Tables 1 and 2)**.

Diagnosis showed moderate anterior wear and generalised mild wear of a primary mechanical cause. The anterior wear was more prominent due to the closed functional 'envelope' and the inverted position of the front teeth. In the posterior region, there were suboptimal restorations with limited restorative space **(Figs. 4-5)**. Taking into account the financial framework indicated by the patient and his preference for minimum orthodontics, the following treatment plan was drawn up:

1. Nine months of aligner therapy to create intrusion and eversion where possible, and optimise the position of the incisors
2. Home bleaching of the upper and lower teeth
3. Lab-prepared wax-up for a predictable bite increase
4. Additive composite restorations (G-ænial A'CHORD) of teeth 33 to 43 with a shell technique
5. Palatal moulding of teeth 13 to 23
6. Injection moulding for molars 36/37 and 46/47 as an interim solution
7. Ceramic Initial LiSi restorations for the mandibular molars

	Chemical factors		Mechanical factors
	Occlusal "cupping", incisal "grooving", 'cratering', rounding of cusps and grooves		Shiny facets, flat and glossy
	Wear on non-occluding surfaces, non-carious cervical lesions (NCCL).	✓	Enamel and dentine wear at the same rate
	"Raised" restorations	✓	Matching wear on occluding surfaces, corresponding features at the antagonistic teeth
	Broad concavities within smooth surface enamel, convex areas flatten, or concavities become present, width exceed depth	✓	Fractures of cusps or restorations
	Increased incisal translucency	✓	Impressions in cheek, tongue and/or lip
	Clean, non-tarnished appearance of amalgams		Located at cervical areas of the teeth, non-carious cervical lesions, NCCL
	Preservation of enamel "cuff" in gingival crevice		Buccal/cervical lesions more wide than deep, non-carious cervical lesions (NCCL)
	No plaque, discoloration or tartar		Cervical areas of premolars and cuspids are affected
	Hypersensitivity	✓	Cracks within the enamel
	Smooth silky-shining, silky-glazed appearance, dull surface		Torus mandibulae

Table 2: Qualitative analysis of wear according to the TWES (Tooth Wear Evaluation Scale) 2.0.4 The qualitative criteria give us an indication of whether the wear is mechanical or erosive in nature. The factors that were present in this case were checked.

Fig. 4a: Suboptimal restorations on elements 46 and 47

Fig. 5a: Suboptimal restorations on elements 36 and 37

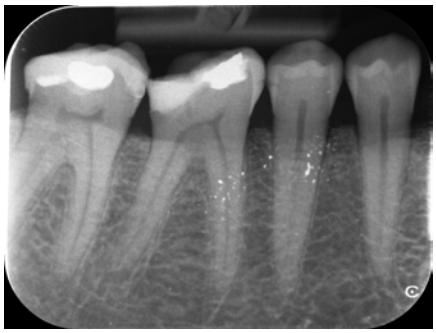

Fig. 4b: Radiography of quadrant 4 shows the suboptimal restorations on 46 and 47

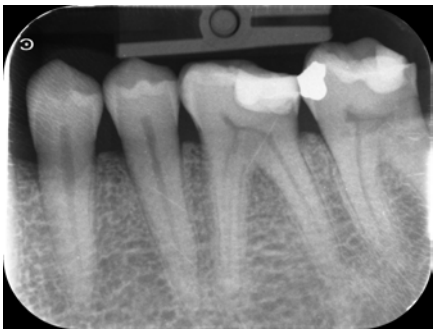

Fig. 5b: Radiography of quadrant 3 shows the suboptimal restorations at 36 and 37

Fig. 6: Slightly opened situation after aligner therapy. A more divided position of the incisors as well as intrusion of the upper incisors can be clearly observed.

8. Replacement of some restorations in the upper jaw with new composite restorations
9. Any aesthetic refinements if necessary
10. Nightguard to protect the composite restorations

Treatment

After aligner therapy **(Fig. 6)**, the anterior upper teeth not only showed eversion and intrusion, but were also better positioned for additive composite treatments. More intrusion was desired in the lower jaw, but this was not fully achieved, as the patient did not completely follow instructions. After the subsequent bleaching, a wax-up was made, in which the 13 to 23 and the 33 to 43, as well as the mandibular molars, were built up. Leaving the mandibular premolars unrestored made it possible to create lingual keys for the front that allowed the bite increase to be transmitted predictably, with support on the premolars.

The restorative treatment commenced with the additive composites in the lower jaw. Rubber dam was placed and a small bevel was prepared to mask the tooth/composite junction. The enamel was sandblasted with 29-µm alumina to remove the aprismatic enamel and obtain a pure substrate **(Fig. 7)**. For adhesion, the enamel was selectively etched and then the universal adhesive G2-BOND Universal (GC) was applied according to the manufacturer's instructions. This bonding system was chosen due to the presence of 10-MDP and the absence of HEMA, which minimises hydrolysis of the hybrid layer and optimises the stability of the bonding.[5]

The lingual shells were made with a putty key based on the wax-up and G-ænial A'CHORD (GC) in shade AE **(Fig. 8).** After curing, the key was removed and the incisal and vestibular layers were applied step by step according to the 'natural layering concept'[6] with composite in different opacities and shades (G-ænial A'CHORD AO3 and AE), to approximate a natural aesthetic outcome. **(Fig. 9)**.

The palatal surfaces of the upper teeth were applied in a predictable manner by a palatal moulding technique[6] **(Fig. 10)**. G-ænial A'CHORD in shades OA3 and AE was also used **(Fig. 11)**. The polymerization process and key removal in this technique require careful handling.
Too little polymerization results in a

Fig. 7: Preparation of the incisors and canines in the lower jaw. A small bevel was prepared to mask the composite/tooth junction.

Fig. 8: Lingual shells in G-ænial A'CHORD (GC), shade AE

Fig. 9: Additive composite buildups in the lower front (G-ænial A'CHORD)

Fig. 10: Palatal moulding technique to build the palatal functional surfaces

Fig. 11: Dentine layering with G-ænial A'CHORD, shade OA3

Fig.12: Injection moulding with G-ænial Universal Injectable as a 'white bite'

Fig. 13: Occlusal reduction

defective composite, while too much makes removing excess material difficult. In addition, the opacity of the dentine-replacement composite must be carefully considered.

After the bite elevation that was necessary for the anterior rehabilitation, the mandibular molars were temporarily returned to occlusion via an injection moulding technique based on the wax-up **(Fig. 12)** awaiting the final restorations. This also functioned as a 'white bite' where the new occlusion could be tested. This 'final' shape also served as a good reference for the tooth preparations for the ceramic restorations.

These provisional molar build-ups were later reduced by about 1.5 mm in two sessions **(Fig. 13)** and then structurally analysed. 'Immediate Dentine Sealing' and 'Deep Margin Elevation' were performed with G2-BOND Universal and G-ænial Universal Injectable composite. The preparation form was optimized with maximum tissue preservation, and the preparation limit was clearly marked using a reciprocating handpiece and an Intensiv Proxoshape file.

Four indirect lithium disilicate restorations (Initial LiSi Press, GC) on teeth 36, 37, 46 and 47 were manufactured by the Ghysens Dental Laboratory **(Fig. 14)**. Lithium disilicate is ideally suited for the treatment of posterior tooth wear, with a high reported durability rate.[7] The restorations were etched with 5% hydrofluoric acid for 20 seconds, cleaned in an ultrasonic bath and silanised. G2-BOND Universal was then applied, followed by a standard protocol for cementation with heated composite **(Figs. 15-17)**.

As a final step, a decision had to be made about the premolars in the lower jaw. Three options were considered: leaving these elements untouched, which would lead to spontaneous eruption of both the upper and lower premolars ('Dahl effect');[8] accelerating this process via orthodontic treatment; or additively building up the lower premolars with composite. The latter option was chosen to maintain the position of the premolars in the upper jaw and thus achieve a predictable result.

Finally, a nightguard was manufactured to protect the composite restorations.

Discussion and conclusion

This case shows how a hybrid technique, using both additive composite restorations for the anterior teeth and glass-ceramic restorations for the posterior molars, offers an effective solution for the restoration of pathological tooth wear caused by parafunction. The combination of aligner therapy, composite and ceramic restorations, and injection moulding for the temporary restoration resulted in a satisfactory aesthetic and functional result. This multidisciplinary approach offers a valuable treatment option for patients with complex forms of tooth wear.

Fig. 14: Initial LiSi ceramic restorations manufactured by dental lab Ghysens

Fig. 15: Overlay preparations mandibular molars (buccal view)

Fig. 16: Overlay preparations mandibular molars (occlusal view)

Fig. 17: Cementing the restorations with heated composite

Fig 18: Smile after treatment

Fig. 19: Lower jaw after treatment

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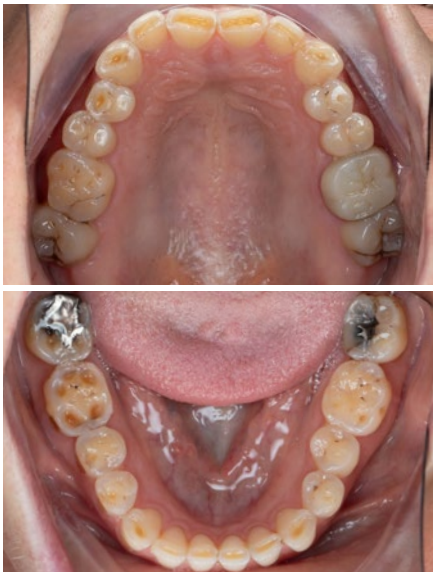
A Conservative Mixed Material Approach to Full Mouth Rehabilitation for Severe Erosive Tooth Wear

By **Dr Zohaib Ali,** United Kingdom

Tooth wear ranks among the leading causes of dental hard tissue damage, second only to dental caries. Tooth wear prevalence is rising in both frequency and severity, even as caries rates continue to decline.[1] Although global estimates remain difficult to establish due to inconsistent diagnostic criteria and study methodologies, erosive tooth wear (ETW) is widely perceived to be increasingly common in contemporary populations.[2] ETW results from the softening of enamel by intrinsic or extrinsic acids[2,3] and can significantly accelerate structural loss when combined with mechanical forces such as attrition and abrasion.[3,4] Parafunctional habits – most notably bruxism – further compound this process, often leading to complex patterns of generalized wear that challenge both function and aesthetics.

Effective management requires a careful balance between restoring occlusal stability, improving appearance, and preserving remaining tooth structure. Minimally invasive, adhesive-based strategies have therefore become central in modern treatment planning. This case report demonstrates a conservative, adhesive-based rehabilitation approach that integrates both direct and indirect adhesive restorations to achieve functional, durable, and aesthetic outcomes while respecting the principles of maximal tissue preservation.

Fig. 1: Extraoral front view before treatment. The shortened and flattened upper anterior crowns significantly affected the patient's smile aesthetics and contributed to a notable psychological burden.



Figs. 2a & b: Intraoral view before treatment: incisal grooving and occlusal cupping indicate a strong erosive component. Note that the right side is more affected than the left side, which might indicate an habitual asymmetric occlusal loading. Amalgam restorations appear shiny and untarnished, which might indicate an acidic environment.

Figs. 3a, b & c: Intraoral buccal view before treatment. Wide and flattened erosive areas can be seen on the buccal surfaces.

A young adult woman visited the dental practice with the chief complaint of functional impairment and aesthetic concerns due to advanced tooth wear **(Fig. 1)**. From her history, she had high acidic dietary exposure and bruxism, daytime and nocturnal. Clinical findings showed generalised severe tooth wear displaying clear erosive and attritional components **(Figs. 2-3).** The combination of erosive softening and attrition worsened the tooth wear, resulting in short clinical crowns and a flattened smile curvature. The dentition showed extensive erosive substance loss, highlighted by pronounced occlusal cupping and distinct incisal grooving. Several restorations appeared "raised," reflecting the progressive loss of surrounding tooth structure, while broad, flattened buccal enamel lesions further indicated advanced wear. Notably, the amalgam restorations were shiny and untarnished, a finding that may be linked to prolonged exposure to an acidic oral environment. Other non-wear related findings included multiple failing restorations, among them a full coverage crown on tooth 26 that required replacement. Overall, the presence of an acidic diet combined with parafunction constituted significant contributing risk factors.

Treatment Objectives and Rationale

The primary treatment objectives were to restore both function and aesthetics while protecting the remaining tooth structure through a minimally invasive approach. A controlled increase in occlusal vertical dimension (OVD) was planned, carefully tailored to the patient's tolerance to ensure comfort and functional stability. Maintainability and reparability were also key considerations, guiding the choice of materials and restorative strategies. To achieve these goals, a predominantly additive treatment plan was selected to preserve the residual enamel and dentine. Direct composite resin was prioritised for its conservative nature and ease of repair, complemented by indirect restorations in high load posterior regions. A single zirconia crown was selected to restore the structurally compromised molar, allowing for a conservative vertical preparation.[5] This material choice supported a minimally invasive approach while providing the strength and long term durability required for posterior function.

Treatment Overview

The full mouth rehabilitation was carried out at an increased OVD using a predominantly additive approach. The length of the anterior teeth was tested via an intraoral mockup **(Fig. 4)**. Treatment began with the upper and lower anterior teeth, completed on the same day. To maintain the newly established vertical dimension during this phase, posterior occlusion was stabilised with temporary composite occlusal stops.

A combined protocol using G-ænial A'CHORD (GC) and G-ænial Universal Injectable was employed for the anterior restorations. A bilaminar technique was followed: a palatal stent was used to create an

Fig 4: Facially driven workflow: Intraoral mock-up to test the length of the anterior teeth

initial shell, followed by a dentine body layer (both G-ænial A'CHORD), and a final enamel layer applied through injection moulding with G-ænial Universal Injectable (Fig. 5).

Four days later, the upper premolars and molars were restored using an injection moulding technique with G-ænial Universal Injectable, followed by the lower premolars ten days thereafter. The lower left quadrant was rehabilitated with semi indirect composite onlays fabricated via injection moulding using G-ænial Universal Injectable (Fig. 6), providing a balance of tooth preservation, cost effectiveness, and long term repairability.

Ten days later, the upper left first molar was restored with a zirconia crown placed following a vertical preparation, offering durable reinforcement for a strategically important posterior tooth.

Finally, lithium disilicate onlays (Initial LiSi Press, GC) were placed on teeth 46 and 47 to deliver enhanced strength and predictable adhesive performance in an area subject to high occlusal loading. These restorations were completed three months later due to patient related scheduling constraints.

Adhesive and Isolation Protocol

All direct composite procedures were undertaken under rubber dam isolation to ensure optimal control of the operative field and maximise adhesive reliability. A combined layering strategy was employed, in which conventional paste composite was used for dentine and enamel replacement, while injection moulding techniques were incorporated to refine final contour, improve precision, and streamline the workflow.

Adhesive protocols were followed according to manufacturer instructions, with substrate specific conditioning and bonding procedures applied to ensure durable interfaces across both direct and indirect restorations. Direct restorations were bonded with G-Premio BOND (GC).

Indirect composite restorations fabricated with G-ænial Universal Injectable were gently sandblasted with 27 µm aluminium oxide and cleaned with alcohol before being silanised with G-Multi PRIMER (GC). The Initial LiSi Press restorations underwent alcohol cleaning, 20-second hydrofluoric acid etching, and subsequent silanisation with G-Multi PRIMER. Prepared tooth surfaces were cleaned and lightly air abraded, followed by selective phosphoric acid etching and application of G-CEM ONE Adhesive Enhancing Primer. Final cementation for all glass ceramic and composite restorations was performed using G-CEM ONE (GC).

The zirconia crown was likewise cleaned and lightly sandblasted prior to cementation with G-CEM ONE, ensuring a reliable bond to the high strength ceramic substrate.

Fig. 5a, b & c: A bilaminar technique using G-ænial A'CHORD (GC) and G-ænial Universal Injectable (GC) as the final layer was employed for the anterior restorations. All adhesive procedures were carried out under rubber dam.

Fig. 6a & b: Semi-indirectly prepared injection moulding restorations reduce chair time while making finishing easier. **a:** G-ænial Universal Injectable restorations on a printed model. **b:** teeth were isolated and gently sandblasted prior to luting.

Fig. 7: Occlusal view of the lower arch. The Initial LiSi Press restorations were not veneered, resulting in an exceptionally smooth, highly polished surface that maintains excellent aesthetics.

Occlusion and Vertical Dimension

The occlusal vertical dimension (OVD) was increased in a controlled manner, allowing ongoing assessment of the patient's phonetics, comfort, and functional adaptation. The new OVD was established through a facially driven workflow that defined the ideal incisal edge position, with subsequent refinements guided by the patient's functional response. Given the determined interocclusal space and the patient's bruxism, a more conservative occlusal anatomy was adopted to reduce interferences or chipping. In the posterior region, the priority was durable function rather than aesthetics, so the occlusal surfaces were meticulously polished and left unglazed to minimise wear[6,7] **(Fig. 7)**. The final occlusal scheme provided stable bilateral posterior contacts supported by an anterior guidance that effectively limited posterior interferences during excursive movements. This configuration respected the patient's functional envelope while promoting a predictable and comfortable occlusal relationship.

Figs. 8 a, b & c: Intraoral buccal view after treatment.

Outcomes

Following completion of treatment, the patient demonstrated a stable occlusion at the newly established OVD **(Fig. 8).** The additive, minimally invasive approach successfully preserved existing tooth structure while providing comprehensive coverage of worn surfaces. Aesthetic outcomes were enhanced through harmonised anterior composite layering **(Figs. 9-10)**, and posterior morphology was effectively restored using direct, indirect and semi indirect restorative modalities. The predominance of composite in the rehabilitative strategy supports long term maintainability, as composite materials allow straightforward polishing, repair, and the option for staged restorative refinement if required.

Maintenance and Risk Management

The long term success of the rehabilitation was supported by a tailored maintenance program. The patient received counselling on dietary modifications aimed at reducing erosive challenges, as well as behavioural guidance to address parafunctional activity associated with bruxism. Protective therapy included ongoing use and periodic adjustment of an occlusal appliance to mitigate excessive loading on the restorations. Regular professional reviews were scheduled to provide hygiene support, monitor the patient's adaptation to the increased OVD, and maintain the integrity of adhesive interfaces, including polishing or repairing composite surfaces as needed.

Fig. 9: A natural surface morphology and texture were restored after treatment.

Fig. 10: Extraoral frontal view after treatment. The natural youthful tooth length and curvature were restored, with the upper incisors gently following the contour of the lower lip and an increased exposure of the teeth during smiling.

Discussion

This case demonstrates that conservative, adhesive-based full-mouth rehabilitation can effectively address severe erosive tooth wear while preserving tooth structure. Materials were carefully selected based on their respective indications. Most of the rehabilitation was completed using composite resin, chosen for its minimally invasive nature, cost efficiency, and excellent repairability, which makes it particularly suitable for long term maintenance in a young patient. A full coverage zirconia crown was placed on tooth 26 to allow minimally invasive vertical preparation and provide the strength and durability required to

restore this structurally compromised molar. In contrast, the partial restorations in the lower right quadrant were fabricated in lithium disilicate, a material selected for its reliable adhesive bonding performance and favourable strength profile, offering an ideal balance between conservation of tooth structure and functional longevity.

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Digitally Handcrafted: Predictability and aesthetics

By **João Paulo Martins,** United Kingdom

João Paulo Martins *(United Kingdom) started to work during his summer holidays in a local dental laboratory to gain some pocket money when he was merely 16 years old. The addiction quickly kicked in, and he saw himself graduating in dental technology. At the beginning, he was working directly with his parents – who were both dentists – in a small, set-up dental lab inside of their practice. By 2013, he had decided to give more to career and moved to London where he worked with who he calls "the best dental technician I've ever met". In 2020, amid the Covid-19 pandemic, he decided to accept an investor's proposal to open a dental laboratory and it turned out a success. Since then, he had the opportunity to choose and work with raw materials, explore their qualities and he could expose his vision for high-quality dental appliances.*

Micro-layering, the right choice

In dental technology, evolution is at full speed and continues to present us with ever more powerful digital tools which are faster and more precise. It doesn't necessarily follow, however, that this makes our work any less challenging or allow for minimal effort in achieving predictable aesthetics. Rather - it presents new tools, new materials, and new techniques to learn and apply.

Layering powders are to us technicians in our work as pollen is to honeybees in theirs - we rely on our materials to reproduce what we see in nature.

Today's dental laboratories face a wide variety of challenges; each case is unique and requires an individual approach. In all-ceramic restorations a technician needs to look deeper, so as not to compromise function, whilst maintaining focus on what characterises the natural tooth and its optical properties to reproduce the most natural looking restoration.

I have found micro-layering using the Initial IQ ONE SQIN System (GC) enables me to achieve this – saving time on complicated build-ups and minimising the potential for chipping.

Initial ONE SQIN ceramics (GC) and Initial Lustre Pastes ONE (GC) work in symbiosis. They are made for each other – literally. In combination together with Initial Spectrum Stains (GC) they form the Initial IQ ONE SQIN System.

In my opinion Initial ONE SQIN and GC Lustre Pastes form the most versatile ceramic system; whether by painting or micro-layering, they set high standards in modern dental technology.

The combination of this ceramics concept is so powerful it really opens doors for us to use our imagination.

Knowing and understanding the materials we use these days is essential. Material selection is most important and the first step in any dental laboratory in helping to understand what you can do in any stage of production, exploring the limits and enabling you to go further.

Here is an example of my simple straightforward way to achieve predictable aesthetics on an all-on-four zirconia bridge using the Initial IQ ONE SQIN System.

The zirconia framework

Fig. 1: Milled Zirconia blank - full anatomic design with a 0,3 buccal reduction

Fig. 2: The blank was stained with liquid presintering stains. For this case we choose an A1 blank with the target to get a required shade A2.
It's important to maintain a high value at this stage; the chroma will be achieved with the Initial IQ Lustre Pastes ONE and the Initial Spectrum Stains (GC).

Fig. 3: The zirconia framework, sintered and ready to be checked on the working model. A silky and matt appearance is a sign of a great sintering process. The structure must always be processed following the instructions of use.

Initial IQ Lustre Pastes ONE: colour and fluorescence

Fig. 4: L-NFL is a neutral, highly fluorescent paste. L-NFL (Lustre Neutral Fluo) was applied in the tooth area. It works as the connection layer and adds fluorescence to the zirconia structure. The L-N (Lustre Neutral) was applied on the gum area as connection layer. L-N does not exhibit fluorescence.

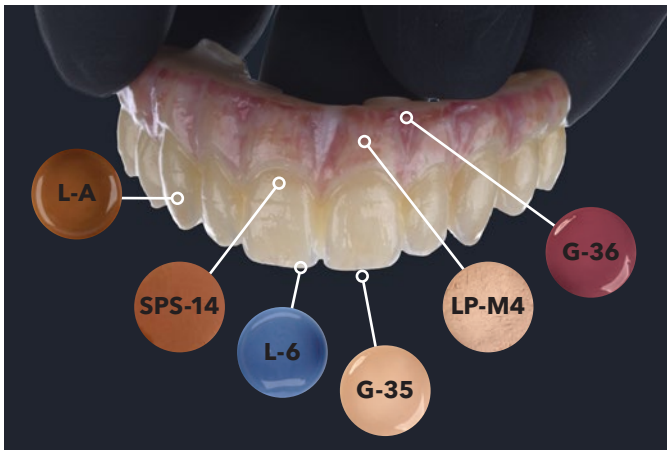

Fig. 5: L-A (Lustre Body A) was used to achieve the required shade; SPS-14 (Spectrum Stain 14 Deep Orange) on neck area to increase the chroma; G-35 (Lustre Gum Intensive Cream) was used to intensify the natural halo effect; L-6 (Lustre Enamel Effect 6 Dark Blue) to create the bluish translucid effect; LP-M4 (Lustre Modifier Brown) and G-36 (Lustre Gum Intensive Red) were used on the highs and the lows of the undulating gingival area, respectively.

Initial IQ SQIN: gloss and surface texture

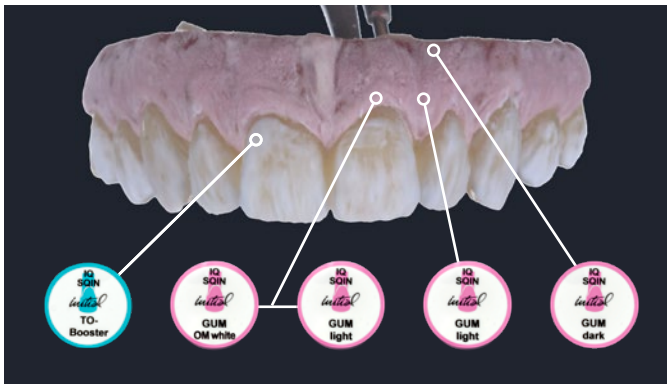

Fig. 6: SQIN TO was used in the tooth area to enhance the natural opalescence and to achieve the final shape and texture. On the gingiva, SQIN GUM Light was used to obtain the final shape and anatomy. The gingival margin was refined using a 50:50 mixture of GUM light and GUM OM white. SQIN GUM dark was used in the area of the alveolar mucosa.

As we navigate the ever-evolving landscape of dental prosthetics, the concept of micro-layering on a zirconia framework is a promising avenue for achieving optimal functional and aesthetic outcomes. The Initial IQ ONE SQIN system is a well-balanced, versatile and comprehensive system that was especially developed for this purpose. It's a user-friendly solution that enables us to achieve the highest aesthetic standards in minimum of time.

The finished prosthesis

Fig. 8: The tissue side is smooth and glossy to prevent the retention of biofilm

Fig. 7: The prosthesis on the model.

Fig. 9: The finished prosthesis

Injection Moulding as a pathway to ceramics in the treatment of severe wear

By **Dr. Kostas Karagiannopoulos,** United Kingdom

Dr. Kostas Karagiannopoulos *is a specialist prosthodontist and an honorary consultant at King's College London. He completed both basic and specialist training in London. He currently works in specialist practice. He has also been teaching and training specialists and dental students at King's College since 2008. His areas of interest are additive adhesive dentistry and natural-looking prosthodontics. Kostas is a key opinion leader for GC and he carries out hands-on courses for injectable composites in the UK and internationally.*

Injection moulding with resin composites has become a versatile tool in the management of tooth wear. As an additive, minimally invasive technique, it allows clinicians to evaluate aesthetics, function, and patient adaptation in real time, offering a cost-effective and biologically conservative approach. It serves not only as a long-term transitional phase toward ceramic rehabilitation but also provides valuable insights that make the final treatment outcome more predictable and comprehensible. This case highlights the strategic use of injection moulding to guide and support a staged pathway toward ceramic restoration.

A 48-year-old man presented with severe generalised tooth wear consistent with attrition and acid erosion. A maxillary rehabilitation in ceramics was planned as the long-term objective. Given the complexity and severity of the patient's tooth wear, along with concerns related to bruxism, injectable composite restorations were chosen to provide a durable provisional phase prior to definitive treatment. Moreover, due to financial considerations, the patient opted to postpone the ceramic rehabilitation for a few years to make it more affordable. Eight resin composite restorations were planned as transitional restorations using the injection moulding technique. A definitive upgrade to ceramics was scheduled approximately 2–3 years later.

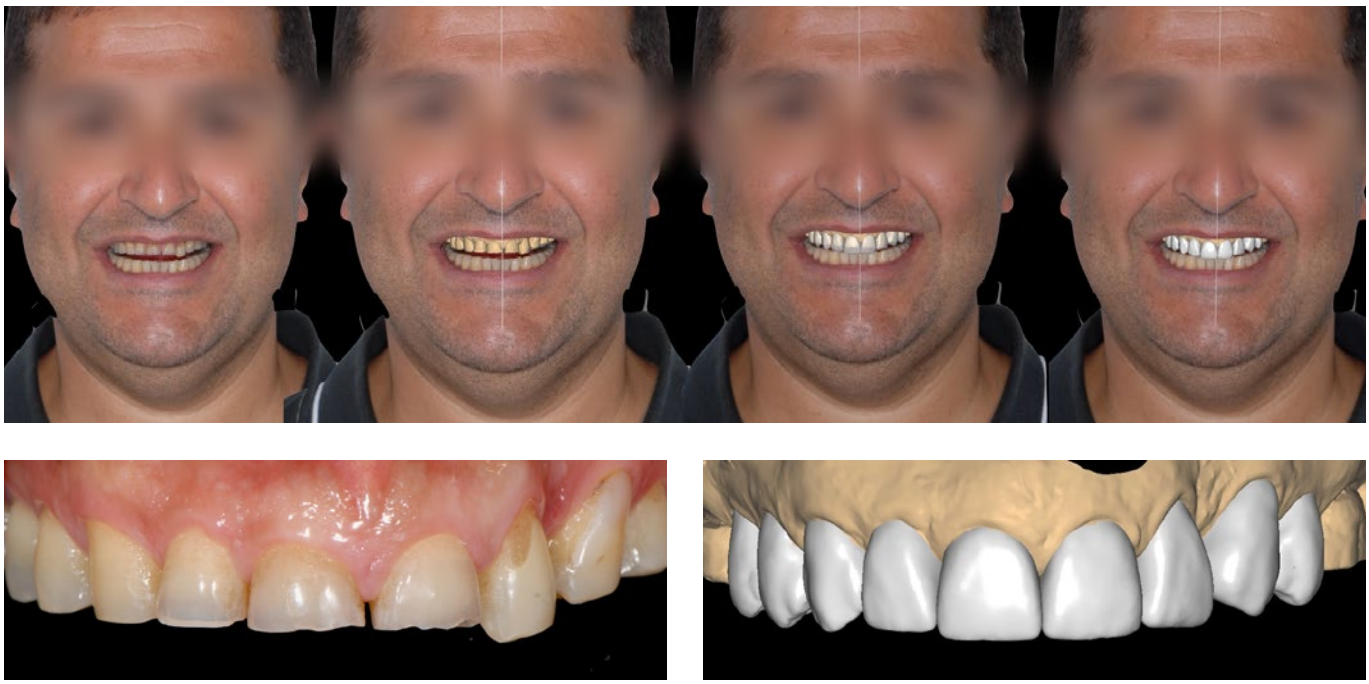

Fig. 1: Facially driven smile design

Irrespective of the restorative materials to be utilised, facially generated treatment planning helps the clinician and lab technician to decide where the teeth need to be.

A digital, additive wax-up was ordered at an increased occlusal vertical dimension. After verifying the aesthetic and functional outcome through an additive, diagnostic mock-up, eight injectable restorations were made using monoshade G'ænial Universal Injectable (GC) following the alternate tooth technique.

Fig. 2: Injectable composites at 2-year review.

Two years after placing the resin restorations, some wear and chippings were evident. By then, the patient felt ready to upgrade to the long-term ceramics. The injectable composites offered valuable information regarding the patient's functional and parafunctional habits. Some features were replicated with an incisal guidance table and others were altered to avoid ceramic fractures. Injectable composites offer an advantage over PMMA or bisacryl long-term provisional restorations. Loosening or chipping of PMMA or bisacryl provisionals may not necessarily indicate occlusal issues and can lead to false-negative assumptions concerning the final ceramic restorations. In contrast, G'ænial Universal Injectable composite offers superior flexural strength and wear resistance, making it a reliable diagnostic tool for designing and evaluating the definitive ceramic restorations.

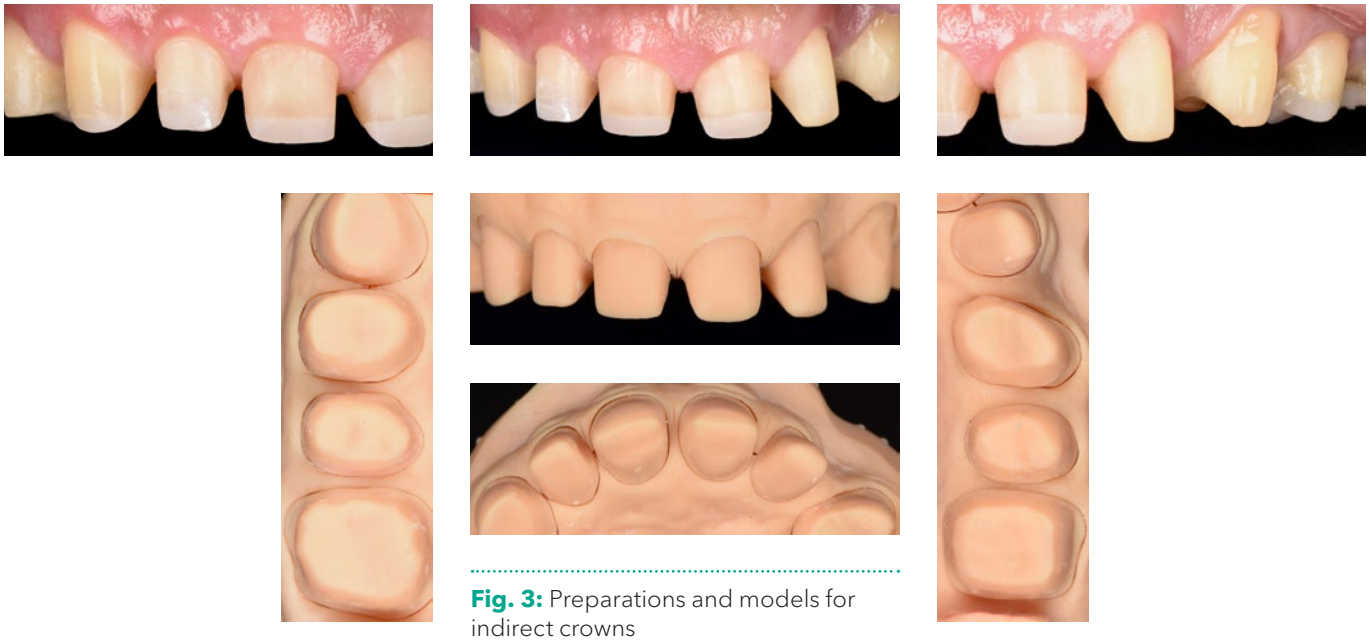

Fig. 3: Preparations and models for indirect crowns

The injectable composites served a dual purpose in the preparation phase for ceramics:

- They provided a reference outcome that guided the tooth preparation.
- They functioned as a core material for the final restorations.

Since the composite build-ups were full-contour and existing proximal restorations were present, full crown preparations were carried out with a 0.3 mm chamfer, in accordance with the requirements for zirconia restorations. Provisional crowns, stained and glazed with OPTIGLAZE color (GC), were provided for a few weeks. Their characteristics were then replicated in the final zirconia crowns.

Fig. 4: Provisional crowns

Fig. 5: Layered zirconia crowns (Technical work by MDT João Paulo Martins)

The zirconia crowns were sandblasted with 29-µm alumina powder and an MDP-containing primer (G-Multi PRIMER, GC) prior to cementing with G-CEM ONE (GC).

Fig. 6: 2-year review of final ceramics

In conclusion, although injection moulding is primarily a direct restorative technique, it can also be effectively integrated in the treatment with indirect restorations, serving as a long-term provisional solution.

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