NO-PREP INTERCEPTIVE REHABILITATION

— of tooth wear using a free-hand technique driven by a functional wax-up

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Treatment rationale

Excessive abrasion (attrition) and erosion are two common conditions affecting dental hard tissue and occur in an increasing number of patients.[1,2] Both can be considered growing challenges in dentistry, because with such patients, especially in cases of severe parafunction, the etiology can rarely be successfully and permanently eliminated.[3–5] Therefore, continuous monitoring to control related pathologies is required.

The most frequent causes of erosion are unbalanced dietary habits with a high consumption of acidic food or beverages (such as fruit, carbonated drinks, fruit juices and vinegar), as well as abnormal intrinsic acid production, such as in bulimia nervosa, acid reflux and hiatal hernia. Insufficient salivary flow rate or buffer capacity and, in general, salivary composition changes induced by various diseases, medications and aging are other etiological co-factors.[6–9] As regards abrasion, awake and sleep bruxism are two different forms of parafunctional activities that can severely affect tooth integrity.[4,5] Preventive and restorative measures are therefore mandatory to correct and limit the extent of further tissue and restoration destruction. An important clinical finding is that a large number of patients affected by hard-tissue loss present combined etiologies, challenging the dental team to determine a multifactorial preventive and restorativeapproach.[1–9]

The dental consequences of abrasion and erosion are manifold and involve a loss of enamel, with progressive exposure of large dentin surfaces, which significantly affects the occlusal, facial and lingual tooth anatomy and has biological consequences too. Objective symptoms or complaints reported by patients are shortening of teeth, discoloration, tooth displacement, dentin sensitivity, as well as an increased risk of decay and premature loss of marginal adaptation of the restoration. The significant impact of tooth wear on occlusion, function and esthetics leads the patient to seek advice and intervention. The biomechanical challenge shall entail a range of treatments involving different specialties, from preventive measures to full-mouth rehabilitation. Intermediate stages (slight to moderate erosion or abrasion) require other clinical measures, such as various forms of adhesive and partial restorations. The aim of this paper is to present a sound clinical concept for addressing various forms of early restorative intervention and their potential to restrict ongoing tissue destruction.

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A comprehensive treatment approach

The modern approach to the treatment of tooth wear aims to stop its progression before full prosthetic rehabilitation becomes indicated, which would require the removal of large amounts of additional tooth substance with potential biological complications[10,11] and a rather inadequate biomechanical rationale. The approach involves three steps:

(1) a comprehensive etiological clinical investigation, including diet analysis and identification of general/medical and local risk factors;
(2) treatment planning and execution, including a proper functional and esthetic wax-up defining the new smile line and tooth anatomy, transferred then to the mouth with a combination of direct and indirect restorations; and
(3) a maintenance program, including a protective night guard and, potentially, repair or replacement of restorations over a medium- or long-term time frame.

The restorative options at hand comprise direct partial composite restorations, indirect partial composite or ceramic restorations, and indirect full-ceramic restorations. Considering the more dramatic failure patterns observed with conventional prosthetic restoration,[10,11] using more conservative restorations, such as partial direct and indirect restorations, appears to have irrefutable advantages and promising outcomes in the treatment of severe abrasion and erosion.[12–14]

Dahl's concept and controlling the vertical dimension of occlusion

The idea of increasing the vertical dimension of occlusion (VDO) to treat or restore patients with abnormal tooth wear has been described and applied for a long time; one of the first clinicians to promote this technique was Dahl, who published many articles on this topic.[15] His approach was to use a metal appliance to elevate the occlusion and allow teeth to move passively until they are again in occlusion and then create space to restore the teeth stabilized by the appliance.[15] The dental movements are intended to occur by combined supra-eruption of occlusally free teeth together with simultaneous alveolar growth and intrusion of teeth maintaining contacts. It was shown that such phenomena would occur in a significant proportion of patients treated according to this concept[16] and the outcomes of such treatment have been corroborated by several recent papers and review articles.[15–19] Increasing the VDO is a key parameter for reversing and preventing the consequences of pathological wear and erosion.[20–25] The passive eruption that accompanies the continuous tissue destruction and loss, tremendously restricts the space available for restorations, which due to their limited thickness, would be very fragile or otherwise require unnecessary removal of the residual tooth structure. Recent clinical reports have largely validated this treatment approach.[23–25]

Treatment outline and restorative options

The decision regarding the optimal restorative choice is usually based on the pre-existing dental condition (presence of decay, restoration, vital or nonvital status), as well as the amount and localization of tissue loss. This means that various restorative options have to be considered and that treatment planning is highly individual (tooth-specific).

The therapeutic scheme is logically oriented toward re-establishing first proper length of the central incisors and anterior guidance, governing thereafter the new VDO. Proper anterior tooth anatomy and function are designed according to objective esthetic guidelines,[26] existing and former tooth anatomy, as well as functional and phonetic components. The first step entails producing study casts in the form of a partial (in the case of moderate posterior tissue loss) or full-mouth wax-up (in the case of advanced generalized tooth wear or erosion; **Fig. 1**).

– Direct composite option

The direct composite option is logically indicated for all forms of moderate to intermediate tissue loss or destruction.[13–16] Among the benefits of a direct composite restoration are its highly conservative approach, the ability to replace or reshape small portions of the tooth, reparability, simplified replacement and relatively limited cost **(Fig. 2)**. Conversely, it is more technique sensitive and might result in thin layers of material over some surfaces, placing them mechanically at risk. When using a sculpting technique, proper anatomy can be created also with a direct technique, favoring the selection of a highly filled material with a firm consistency.[27–29] In the case illustrating this treatment modality, a highly filled homogenous nanohybrid material (inspiro, Edelweiss DR) was used owing to its firm consistency, favorable for free-hand sculpting and modeling **(Figs. 2f–l)**.

– Indirect composite option

The indirect option is logically preferred when larger restorations or tissue destruction of a greater severity is present. It also provides greater control of the anatomy and occlusion in complex or advanced cases. Nevertheless, one should not neglect the direct option only in favor of this last parameter, as occlusion seems not to play a major role in the origin of parafunction.[4,5,30–32] Since direct and indirect techniques can be used together to treat the same patient, when indirect restorations are chosen, they have to be fabricated first, at the new VDO, and then direct composites placed.

– Material selection

Today, the debate about whether ceramics or composite is best indicated for such restorations is sometimes based on personal experience and belief, rather than on scientific or clinical evidence. The rather abundant clinical literature dealing with the clinical behavior of composite and ceramic inlays and onlays has not shown a major advantage of either material.[33, 34] I clearly favor composite in the context of tooth wear. Were ceramics to be chosen, the Empress material (Ivoclar Vivadent), which has shown limited annual failure rates,[35] and, of course, today's new lithium disilicate pressed ceramic (IPS e.max Press, Ivoclar Vivadent), with improved flexural strength and fatigue resistance,[36] would be considered the best choice.

Longevity of restorations placed to correct severe tooth wear and erosion

Clinical studies have demonstrated that the performance of composite in the treatment of advanced tooth wear is adequate and that partial fractures represent the most likely complication. These can be corrected by a repair or uncomplicated replacement of the restoration.[37–39] The ten-year survival rate of porcelain-fused-to-metal crowns has been proved to be slightly superior to that of composite restorations, but with much more severe complications: Porcelain-fused-to-metal failures led mainly to endodontic treatments or to extractions, while composite failures or fractures could be either repaired or replaced.[40] This again demonstrates the reason the conservative and adhesive approach is favored for treating all kinds of mild to moderate forms of tooth wear and erosion.

Conclusion

The incidence of tooth wear represents an increasing concern for the dental team and has multifactorial origins. Behavioral changes, an unbalanced diet, various medical conditions and medications inducing acid reflux or influencing salivary composition and flow rate trigger erosion. In addition, awake and sleep bruxism are widespread functional disorders that cause severe abrasion. It is then increasingly important to diagnose early signs of tooth wear so that proper preventive and, if necessary, restorative measures are taken, with the focus on biomechanics and long-term tissue preservation.

Acknowledgments

I would like to thank Serge Erpen (Oral Pro, Geneva, Switzerland) for the fabrication of the wax-ups presented in **Figures 2d and f**.

Fig. 1
Comprehensive treatment scheme for anterior and posterior tooth wear or erosion. The length of the anterior teeth is reduced by combined wear or erosion **(1)**. The VDO needs to be augmented **(2)**. On the models and based on a wax-up, a new anterior guidance and smile line are established **(3)**, from which an index is made and transferred to the mouth when proceeding with posterior restorations **(4)**. Three different conditions are encountered in the posterior areas:

(a) no or minimal tooth loss (occlusal stops are made with composite of any type);
(b) moderate tooth loss and/or small to medium-sized restorations (occlusal morphology is re-established with a hybrid composite and direct technique); and
(c) severe tooth loss and large metal-based restorations (occlusal morphology is re-established with indirect tooth-colored restorations—overlay).

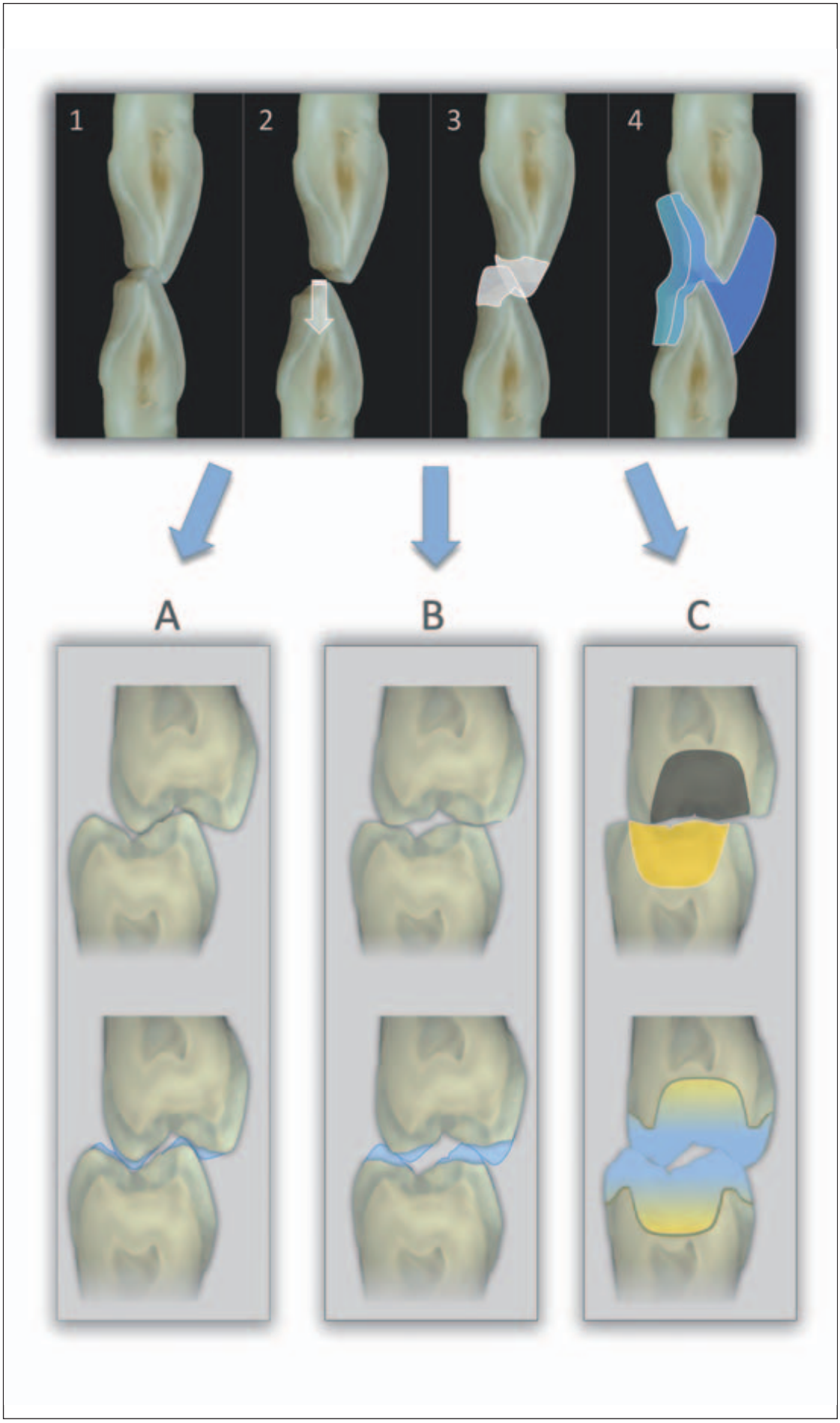

Fig. 1

Fig. 2a

Figs. 2a–c
Pre-op situation showing moderate to severe tooth wear, due to combined abrasion and erosion etiologies. However, the amount of tissue loss does not speak in favor of a conventional prosthetic solution; rather, an interceptive solution using direct composite restorations would be used in this case.

Fig. 2b

Fig. 2c

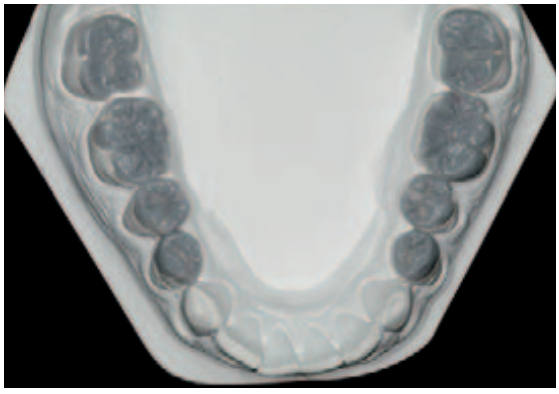

Fig. 2d

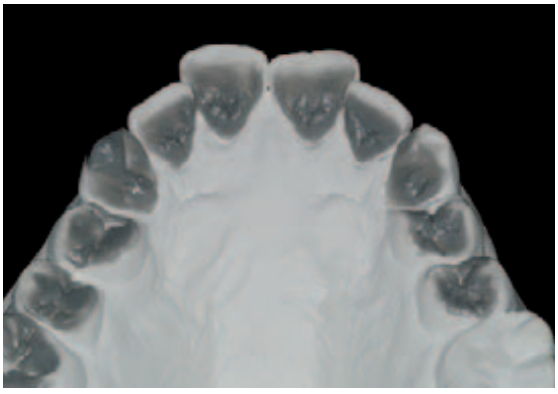

Fig. 2e

Figs. 2d & e
Pre-op diagnostic wax-up, creating a new and improved occlusal and anatomical posterior scheme. The full-mouth wax-up is made prior to treatment and establishes the new VDO. Silicone indexes can serve to build up lingual and buccal cusps to the correct level if needed.

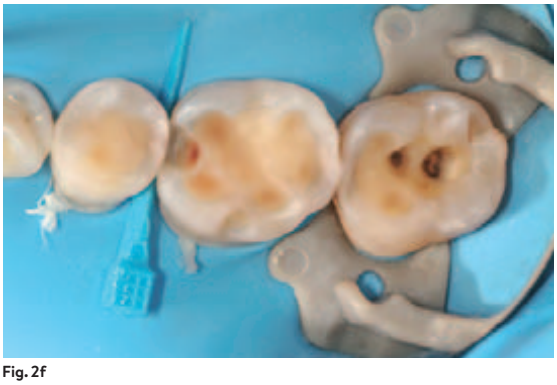

Fig. 2f

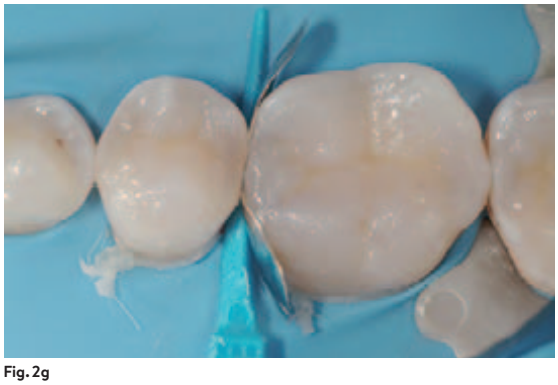

Fig. 2g

Figs. 2f–l
Details of the treatment performed in the lower left and upper left quadrants, respectively. After rubber dam placement, amalgam fillings were removed and tooth surfaces prepared and cleaned with sandblasting, before applying composite. A highly filled homogenous nanohybrid material (inspiro) was used and sculpted before light curing, enabling proper anatomy and function to be established.

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Fig. 2h


Fig. 2i

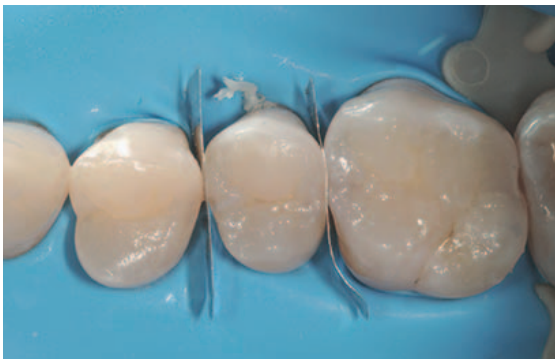
Fig. 2j


Fig. 2k

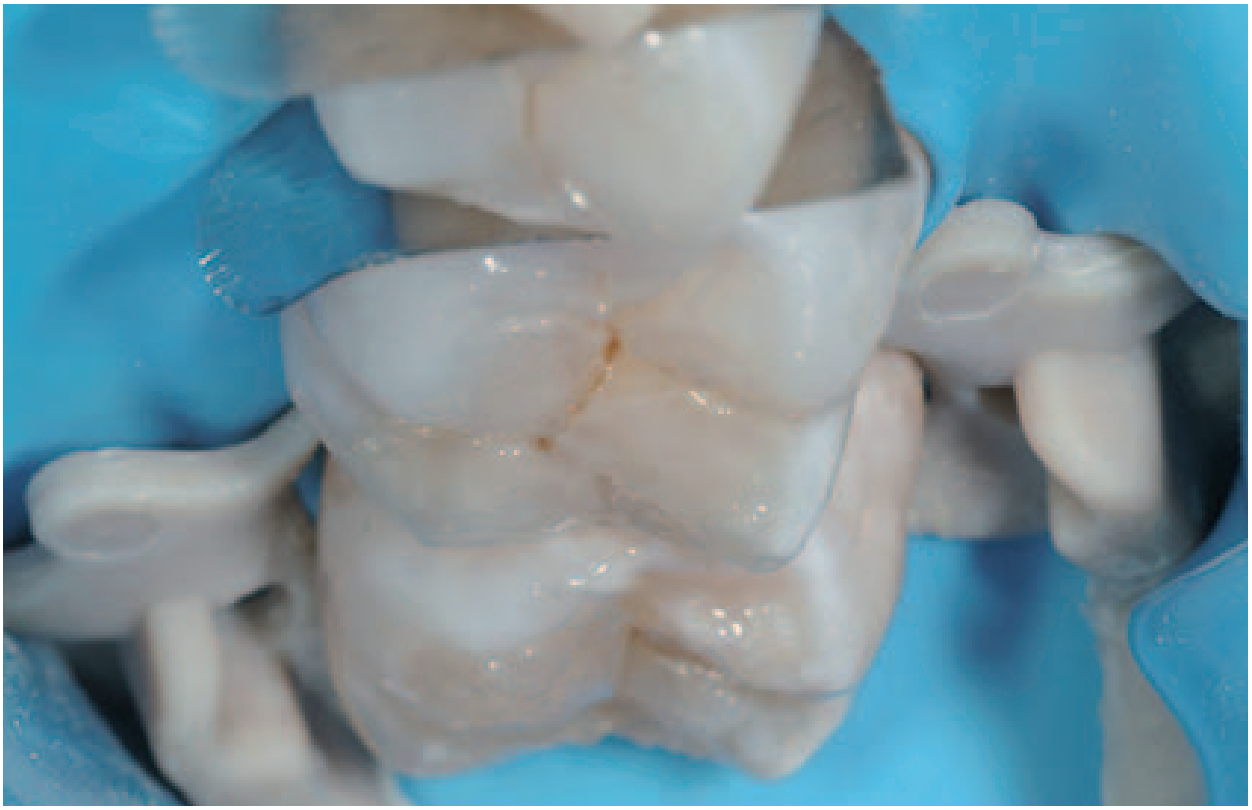
Fig. 2l

Fig. 2m

Fig. 2n

Figs. 2m & n
The same treatment sequence was applied to all of the lower and upper quadrants. These images show that composite serves both to fill existing cavities and to replace eroded or worn tissue, creating better function, restabilizing proper anatomy and esthetics, and finally protecting damaged tissue from further degradation. This is an ideal treatment protocol for moderate tooth wear combined with small Class I and II cavities.

Figs. 2o–q
Smile and occlusal views of this full-mouth rehabilitation, using only direct restorations. Such an approach is highly conservative, comfortable for the patient owing to the short treatment time, and cost-effective.

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Fig. 2p

Fig. 2q

Fig. 2r

Fig. 2s

Figs. 2r & s
Five-year recall. The patient never did wear a night guard despite it being recommended. We can observe some additional tooth wear, mainly of an erosive nature (see, for instance, the cervical areas of the mandibular pre-molars). The restorations however show minimal wear or volume loss, apart from microfractures of a few margins (i.e., teeth #46 and 47).