

# Aesthetic/functional rehabilitation of mandibular incisal edge defects

Claus-Peter Ernst<sup>1</sup>

Parafunctional defects of the mandibular incisors develop over years and decades. It is only when the exposed dentine begins to turn dark that patients notice the defects. These initially very small, collar-shaped defects can and should be treated restoratively before the enamel collar, which is no longer dentine-supported, crumbles: This would lead to actual class IV defects, which would be much more complex to treat. This article aims to illustrate a possible care concept for this on the basis of two clinical treatment cases.

## Introduction

If, physiologically or unphysiologically, the bite decreases over the years, this first becomes visually apparent to the patient at the incisors. Depending on the bite position, the incisal edges of the upper incisors or the incisal edges of the lower incisors thin out first due to a lack of palatal support. We see such findings on a daily basis - however, these are described disproportionately rarely in the literature.<sup>14</sup> One publication, which only marginally touches on the findings presented here, even warns of possible endodontological consequences:<sup>1</sup> In the article, the authors describe the possibility of bacterial penetration of microorganisms via open dentinal tubules into the pulp and a possible resulting provocation of pulp necrosis. Of course, this risk is greater in adolescent patients with the dentinal tubules still wide open than in the two patients presented here; however, this information should be kept in mind when talking to patients about a possible treatment indication.

As a rule, on closer inspection, incisal defects on the canines are often impressive in addition to the incisor defects, which often indicates a worn-in group guidance. Here, too, restorative therapeutic approaches should be considered.<sup>8</sup> Sometimes even orthodontic pre-treatment must be considered.<sup>7</sup>

Looking at mandibular incisal defects, the main indication for treatment is primarily the prevention of eruption of the fragile enamel margins, which currently appear to be frayed. Further attrition and abrasion can easily lead to further enamel fractures, which then result in a more significant loss of vertical height, taking into account both aesthetic and functional as well as technical-restorative aspects. If, on the other hand, the "enamel collar" is still largely intact, it can be restored very easily in the form of a small incisal edge restoration – if necessary extended in the incisal-labial direction. It is important to take advantage of this opportunity: the easier and faster a restoration is successfully placed, the higher the success rate and longevity are likely to be.

When selecting materials for such incisal Class-I restorations, the entire range of restorative materials is available: from flowables to paste-like materials. The personal preference of the practitioner and the given handling characteristics are likely to be

<sup>1</sup> Prof. Dr Claus-Peter Ernst  
Professor, Polyclinic for dental  
conservation, University Medicine  
of the Johannes Gutenberg-  
University Mainz, Germany  
Private Practice, Mainz, Germany

of greater importance here than physical-technical aspects. Nevertheless, these must of course not be neglected.

In any case, the use of a low-viscosity material facilitates the application to the defects on the incisal edge, which are often narrow, and enables optimal wetting and flow behaviour. However, vertical construction often needs to be carried out in several individual portions, as unintentional slumping of the materials often makes their application more difficult. In the case of paste-like materials (even if they are heated), the application into the filigree cavities and their bubble-free wetting is not really easy. An ideal solution seems to be the use of an injectable universal filling material, which guarantees good wetting, but does not flow away like a paste-like material. As early as 2018, the company GC introduced G-ænial Universal Injectable, a material that, in addition to the regular restoration of all Black's cavity classes, quickly also established itself in niche indications that could not previously be optimally supplied with conventional materials. The treatment of such incisal edge defects is definitely part of it.

### Case 1

During a routine check-up, a 69-year-old patient spoke to the treatment team about his lower incisors, which he considered unsightly: he found them too dark at the incisal edge. He did not notice the incisal outbursts with the clearly recognisable depressions (Fig. 1). Drawn to the basic problem and the risk of the enamel margins breaking off, he quickly saw the need for preventive restorative therapy and agreed to the proposal to treat teeth 34 to 43 with direct composite restorations. In a separate, one-hour treatment appointment, a discreet and minimal grinding of the inner surfaces of the enamel edge and the sclerotic, darkly discoloured incisal dentine was carried out after local anaesthesia. After rubber



Fig. 1: Incisal wear with clearly recognisable depressions and aesthetically disturbing discolourations.

dam isolation and phosphoric acid etching in the sense of "Total Etch" (37.5 %, Gel Etchant, Kerr, Fig. 2), a universal adhesive (G-Premio-Bond, GC) was applied after careful rinsing. Today, universal adhesives represent the ideal compromise between quality and ease of application for such indications.<sup>10</sup> A very narrow micro-brush (Microbrush X, Microbrush International, Young Innovations Europe GmbH) was used for the application of the adhesive, as this was the only way to reach the narrow, incisal "shaft" up to the base of the cavity (Fig. 3). After light polymerisation of the adhesive, the injectable, low-viscosity restorative material G-ænial Universal Injectable could be injected (shade A3). For application in a narrow cavity, the tip of the syringe plays an important role. A probe can be used to spread the thixotropic material carefully on the bottom. Using a more narrow tip is another possibility and allows bubble-free application without the use of a probe, but might require a significantly higher squeezing pressure - which is not everyone's cup of tea - and clogging of the tip occurs more



Fig. 2: Phosphoric acid conditioning after preparation and rubber isolation.



Fig. 3: Application of the adhesive with a very fine micro-brush.



Fig. 4: Application of the injectable, low-viscosity restorative material with the help of a very thin cannula.



Fig. 5: Light polymerisation of the restorative material for every 20 s.



Fig. 6: The finished incisal edges still under rubber dam.



Fig. 7: Situation immediately after finishing and polishing.



Fig. 8: Clinical situation at a follow-up after 6 months (view from labial).



Fig. 9: Clinical situation at a follow-up after 6 months (view from incisal).

rapidly. Figure 4 shows how the cavity bottom of tooth 41 is reached with a thin cannula. Each restoration was light-cured for 20 s with a high-power LED curing device (Elipar Deep Cure, 3M, Fig. 5). Mentioning light polymerisation here may seem trivial, but it is essential for the long-term success of adhesive restorations.<sup>4-6,9</sup>

Figure 6 shows the fully polymerised incisal edge coverings of the mandibular front immediately after completion still under rubber dam; Figure 7 shows the same situation immediately after finishing and polishing, and Figures 8 and 9 during a follow-up after 6 months. The restorations fully met the patient's expectations, could be placed minimally invasively and were extremely user-friendly due to the consistency of the selected restorative material.

## Case 2

The second case shows the clinical situation of a 59-year-old female patient with partial edentulism in the lower jaw and whose further mandibular treatment consisted of a cast partial denture (Fig. 10). An extension of the incisal defects to clean, caries-free dentine was carried out according to the procedure presented in case 1. Figure 11 illustrates the cavities of different depths (already under rubber insulation), Figure 12 illustrates the phosphoric acid conditioning (37.5 %, "Total Etch", Gel Etchant, Kerr) and Figure 13 illustrates the resulting "frosty" etching pattern of the melting surfaces.

The narrow type of microbrush as used in case 1 was too large to transport the adhesive into the depth without too much pressure on the remaining lateral enamel walls.



Fig. 10: Preoperative situation of a patient with incisal defects that is only partially edentulous in the lower jaw.



Fig. 11: The prepared incisal edges revealed cavities of different depths.



Fig. 12: Total-etch phosphoric acid conditioning.





Fig. 13: The "frosty" etching pattern of the enamel surfaces.



Fig. 14: Application of the universal adhesive with a classic brush.



Fig. 15: Application of the injectable low-viscosity restorative material.

For this reason, a classic brush (Mirabrush regular, Hager & Werken) was used in this case (Fig. 14). Here, too, after the light polymerisation of the adhesive, the injectable, low-viscosity restorative material G-ænial Universal Injectable could be injected in shade A3.5 selected for this case. Just as in case 1, a fine type 45 cannula was used for the application of the injectable material (Fig. 15). Figure 16 shows the fully polymerised incisal edge restoration of the mandibular front still under rubber dam, Figure 17 shows the same situation after the adjustment of the protrusion sheets

and the polishing - now already with the mandibular model cast prosthesis reinserted. Figures 18 and 19 show the stable and aesthetic final result again after a further check-up after 5 months. This restoration result also corresponded exactly to the patient's ideas and her desire for a simple, minimally invasive, yet aesthetic incision edge restoration.

### Discussion

The combination of materials presented here is certainly just one of many. The primary selection was made based on the



Fig. 16: The fully polymerised incisor edge abutments of the mandibular front still under rubber dam.



Fig. 17: Situation after adjustment of the protrusion sheets and polishing.



Fig. 18: The stable and aesthetic final result with a further check-up after 5 months.



Fig. 19: View with additional lingual contrastor for better visualisation of the incisal edge areas.

handling properties: There was a lot to be said for the use of a stable, injectable low-viscosity restoration material. It is pleasing to note that – after reviewing the literature published on the material in peer-reviewed journals so far – no compromises have to be made in terms of physical properties with regard to the material quality: With regard to abrasion behaviour in a 2-body wear test, the “injectable” restorative material G-ænial Universal Injectable used surpasses both Filtek Bulk Fill and the new G-ænial A'CHORD.<sup>12</sup> In another study on mechanical properties,<sup>3</sup> G-ænial Universal Injectable showed comparable Vickers surface hardness to SonicFill (Kerr). In the same study, G-ænial Universal Injectable was found to have the lowest surface roughness and the lowest abrasion-related volume loss after thermal cycling loading in a chewing simulator. Beautifil Injectable X and SonicFill 2 showed statistically significantly higher roughness values and abrasion-related volume losses. The study revealed (as expected) a highly significant correlation between the roughness values and the determined volume loss ( $p = 0.001$ ,  $R^2 = 0.9803$ ). Another study confirmed these data: G-ænial Universal Injectable, together with G-ænial Universal Flo, showed the smoothest surfaces after finishing and polishing, and therefore the lowest adherence of *S. mutans*.<sup>15</sup>

For the further prevention of further, possibly unnoticed parafunctional progression, the adjustment of a mandibular anti-bruxism splint is a useful follow-up measure.<sup>2,11</sup>

## References

1. Arnold M, Paqué F. The anatomy of mandibular incisors and canines *zm* 2018; 108, 2110-2117.
2. Burian, G.; Erdelt, K.; Schweiger, J.; Keul, C.; Edelhoff, D.; Güth, J.-F. In-Vivo-Wear in Composite and Ceramic Full Mouth Rehabilitations over 3 Years. *Sci. Rep.* 2021, 11, 14056.
3. Elsahn NA, El-Damanhoury HM, Shirazi Z, Saleh ARM. Surface Properties and Wear Resistance of Injectable and Computer-Aided Design/Computer Aided Manufacturing-Milled Resin Composite Thin Occlusal Veneers. *Eur J Dent* 2023; 17: 663-672.
4. Ernst CP. Light polymerization. In: Frankenberger, R.: *Adhäsive Zahnheilkunde*, Deutscher Zahnärzte-Verlag, Cologne 2013, pp. 35-80.
5. Ernst CP, Price RB, Callaway A, Massek A, Schwarm H, Rullmann I, Willershausen B, Ehlers V. Visible Light Curing Devices - Irradiance and Use in 302 German Dental Offices. *J Adhes Dent* 2018; 20: 41-55.
6. Ernst CP. Keep your eyes open when buying lamps. *ZMK* 2019; 35; 14-20.
7. Ernst CP. Veneer restorations after orthodontic pretreatment: A multidisciplinary treatment approach. *ZMK* 2023; 39: 414-430.
8. Ernst CP. Leadership roles. *ZMK* 2023; 39: 484-503.
9. Ferracane F, Watts DC, Barghi N, Ernst CP, Rüggeberg FA, Shortall A, Price R. The efficient use of light curing equipment – a guide for dentists. *ZMK* 2014; 30 (4): 166-180.
10. Frankenberger R, Dudek M-C, Krämer N, Winter J, Roggendorf MJ. The 10 most popular mistakes in adhesive technique. *DZZ* 2022; 77: 238-244.
11. Hardan L, Mancino D, Bourgi R, Cuevas-Suárez CE, Lukomska-Szymanska M, Zarow M, Jakubowicz N, Zamarripa-Calderón JE, Kafa L, Etienne O, Reitzer F, Kharouf N, Haikel Y. Treatment of Tooth Wear Using Direct or Indirect Restorations: A Systematic Review of Clinical Studies. *Bioengineering* 2022; 9: 346.
12. Lassila L, Novotny R, Säilynoja E, Vallittu PK, Garoushi S. Wear behavior at margins of direct composite with CAD/CAM composite and enamel. *Clin Oral Investig* 2023; 27: 2419-2426.
13. Ludovichetti FS, Lucchi P, Zambon G, Pezzato L, Bertolini R, Zerman N, Stellini E, Mazzoleni S. Depth of Cure, Hardness, Roughness and Filler Dimension of Bulk-Fill Flowable, Conventional Flowable and High-Strength Universal Injectable Composites: An In Vitro Study. *Nanomaterials* 2022 7; 12(12): 1951.
14. Manhart J. Aesthetic analysis for composites in the anterior region. Determination of tooth color and individual characteristics. *Lower Saxony Dental Journal* 2022 (1): 18-27.
15. S, Stašić JN, Ilić J, Todorović M, Jevremović D, Milić-Lemić A. Effect of different finishing and polishing procedures on surface roughness and microbial adhesion on highly-filled composites for injectable mold technique. *J Esthet Restor Dent* 2023; 35: 917-926. 2009 Jun;25(6):820–7.

*Reprinted with permission from GC get connected*