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Objective aesthetic performance of Icon treatment by deep infiltration: a case report

Fabrizio Guerra, Marta Mazur*, Gianna Maria Nardi, Denise Corridore, Debora Pasqualotto, Francesca Rinaldo, Livia Ottolenghi.

Affiliation: Department of Oral and Maxillo-facial Sciences, Oral Diagnosis Unit, "Sapienza" University of Rome, Via Caserta, 6 -00161 Rome, Italy.

*Corresponding author: e-mail: marta.mazur@uniroma1.it; Tel.: +39 0649978151.

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Abstract

Enamel hypomineralization is characterized by decreased refractive index of the lesion surface as compared to the surrounding sound enamel. Icon® treatment has been recently successfully used for the cosmetic treatment of enamel demineralizations seen in white spot lesions (WSLs) and developmental defects of enamel (DDE). On the other hand, cases of molar incisal hypomineralization (MIH), deep lesions of traumatic origin, and those associated with severe fluorosis do not have the same response to this type of treatment. The application of a new deep Icon® infiltrative technique is proposed and the aesthetic results are validated by using a spectrophotometric approach as previously described by our group.

Keywords: *enamel hypomineralization; deep Icon® infiltrative technique; resin infiltration.*

Introduction

Enamel hypomineralization has been recently succesfully treated by resin infiltration by Icon®, which has been previuosly used for the interproximal enamel non cavitated caries in the posterior segment. Resin infiltration treatment has been found to have a positive effect on the refractive index (RI) of demineralized enamel. Paris and colleagues have described the effect of rising the RI of infiltrated lesions that, immediately after the procedure, took on the appearance of the sound surrounding enamel [1].

We previously described the successful effect of resin infiltration on WSLs, DDEs and mild cases of fluorosis [2] [3]. On the other hand, lesions with deeper configuration in the enamel layer such as MIH, certain types of hypomineralization of traumatic origin, and severe cases of fluorosis did not seem to have the same response to this treatment. In the past these type of lesions have been treated with more aggressive and invasive methods, such as ceramic veneers. These treatment are not always affortable by patients, expecially young and in the hospital setting.

We present the application of deep infiltrative technique as described by Attal et al., in a post traumatic case and the spectrophotometric evaluation of the aesthetic outcome [4].

Case report

The patient is a 15 years old female who was found to have a hypomineralized lesion on upper right central incisor. The lesion appeared as a demarcated white defect, clearly detectable and affecting patient's self esteem. After discussion, the parents requested for a non invasive treatment of the hypomineralized defect.

Visual objective spectrophotometric and intraoral photographic images (Nikon D7100, 105 mm Macro lens, R1C1 Macro flash) were taken before and after treatment to evaluate the difference in tooth shade between the affected central upper right incisor and the simmetrical one on the left side.

Spectrophotometric measurements before and after treatment against black background (L* = 1.6, a^* = 1.2, b^* = -1.0) were performed in order to evaluate the aesthetic outcome of the procedure. A calibrated reflectance spectrophotometer (SpectroShade, MICRO, Serial N HDL1407, MHT, Arbizzano di Negrar, Verona, Italy) was used for quantitative assessment, the device being perpendicular to the clinical crown labial surface in order to obtain reproducible measurement settings. To define the effectiveness of the treatment, the MHT software divides the vestibular tooth area into three equal sections (gingival, central, and incisal) along the median axis.

Spectrophotometric technical functioning and operative procedures have been conducted as described in a previous study from our group [5].

Spectrophotometric analysis: the colour difference ΔE, which quantitatively assess the colourimetric shade variation after Icon® treatment for each tooth section was described by the formula from the CIE-L*a*b* system [6], which estimates uniformed Euclidean distances between colour coordinates while totally covering the visual colour space [7]:

$$\Delta E = \sqrt{(L_1 - L_2)^2 + (a_1 - a_2)^2 + (b_1 - b_2)^2},$$

where, L_1, a_1, b_1 represent before treatment tooth CIE $L^*a^*b^*$values and L_2, a_2, b_2 after treatment CIE $L^*a^*b^*$values. The L^* value (y-axis) measures the lightness ranging from 0 (black) to 100 (white), the a^* value measures redness (a* >0) or greenness (a* <0), and the b^* value measures yellowness (b* >0) or blueness (b* <0).

ΔE was calculated in each of the three dental sections to assess the colourimetric variation. Then the quantitatively assessed amount of shade difference before and after Icon deep infiltrative treatment was correlated to human eye perception acceptability and perceptibility thresholds (AT and PT). Following mostly cited authors, we defined AT=3.3 and PT =1.1 [8] [9]. The comparison of the quantitatively assessed colour difference with the chosen thresholds provides clinical significance to colour matching procedures [10]. In this specific clinical case the ΔE value defines both the perceptibility of the existing lesion when compared with the corresponding left upper incisor as the amount of colour difference after the deep infiltration.

Consent for the treatment was obtained.

ICON deep infiltration clinical procedure

Enamel resin deep infiltration clinical procedure steps are described in Figures 1 to 7.

Figure 1: A. and B. Frontal and lateral view of the white spot of traumatic origin on 11.

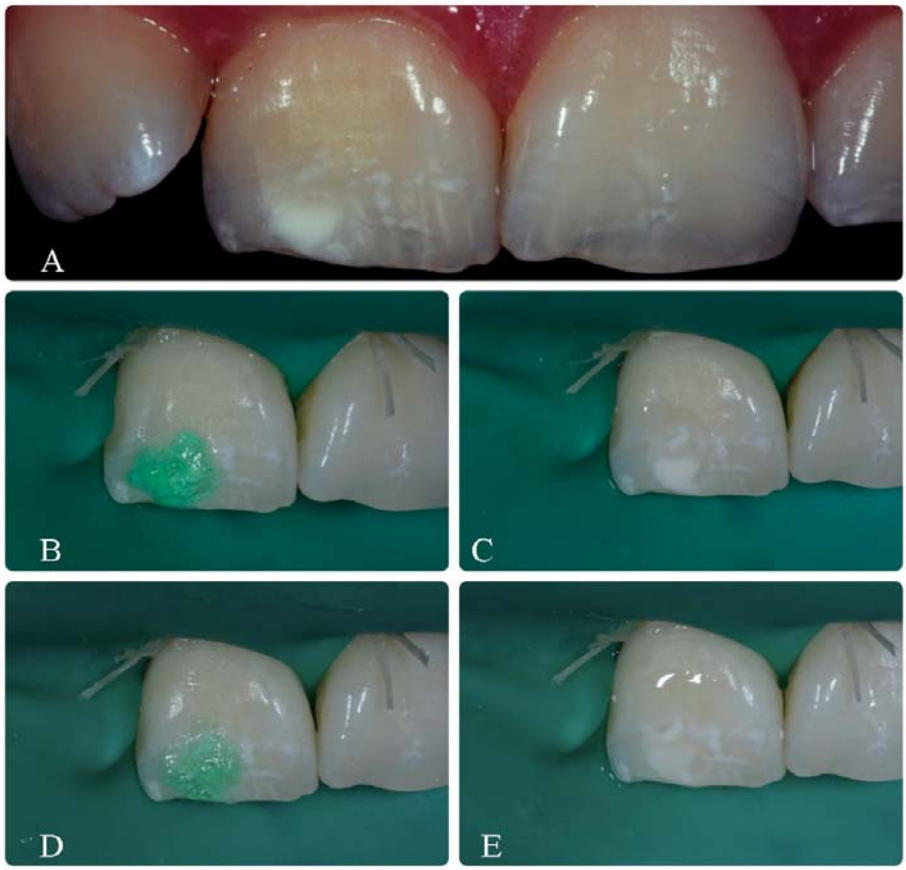

Figure 2: A. Polarized image of the defect; B. Application of Icon Etch (15% HCl) for 2 minutes; C. After rinsing and drying with alcohol, the masking of the spot is not achieved. The application of Icon Etch should therefore be repeated; D. Second application of Icon Etch; E. After rinsing and drying with alcohol, masking of the spot seems not favorable. A third application of Icon Etch have been performed. To accelerate the procedure, the acid can be rubbed in for a few seconds using a microbrush or the syringe tip supplied.

Figure 3: After elimination of 0.2 to 0.3 mm and surface treatment of the spot by 15% HCl. The spot is markedly opaque. In traditional dentistry, it is not possible to hide this kind of opacity using only a composite thin layer.

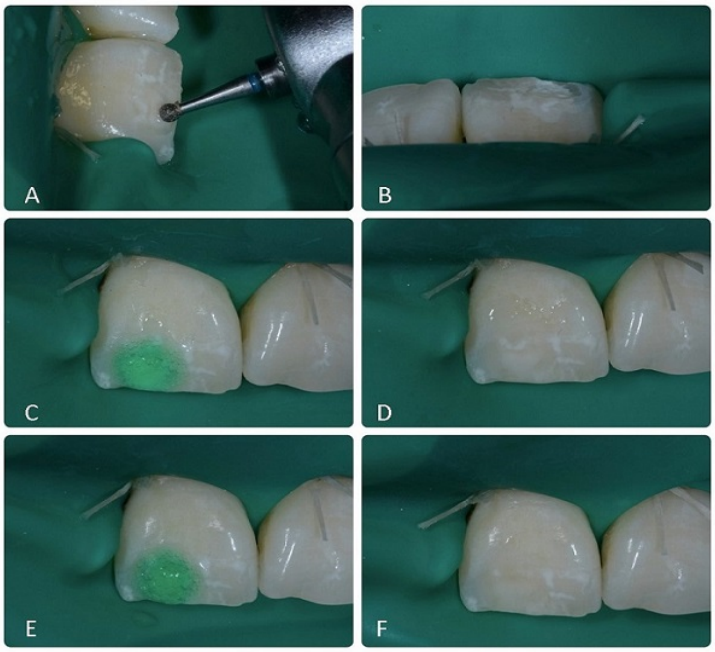

Figure 4. A. After a cycle of milling; B. the amount of the tissue eliminated is shown; C. a new cycle of erosion and alcohol is performed and the optical appearance is improved but there are still zones, essentially peripheral, that remain unchanged; D. and E. After a further cycle of erosion and alcohol, the optical change now concerns all lesions in totality and infiltration is possible.

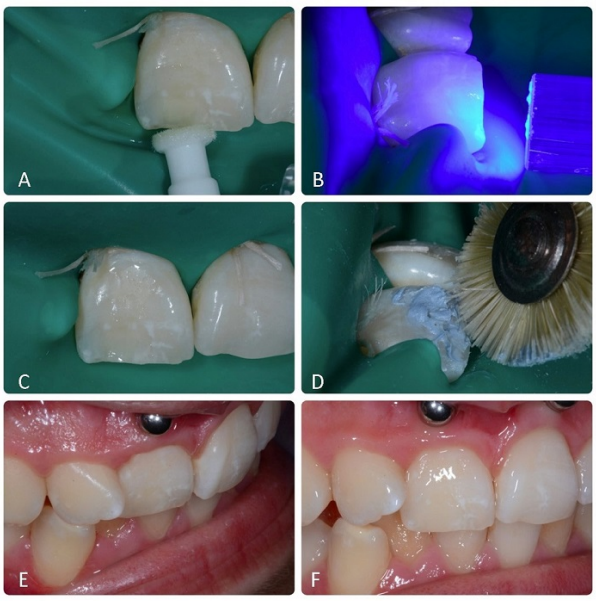

Figure 5: A. and B. After the first application of Icon Infiltrant and light-curing for 60 seconds, the spot is well masked; c. and d. as resulting from the infiltration all lesions are translucent: we restore the enamel profile by bonding a very small volume of composite, then polished; e. and f. different views of the final result. The small white spots on the left side of the treated lesion appeared as a result of 1 hour enamel dehydration, due to the rubber dam. They will disappear once the tooth will rehydrate.

Figure 6: Frontal view immediately after dum removal.

Figure 7: Smile of the patient showing the aesthetic result.

Table 1

1.1 by tooth section pre-post	ΔE			ΔL			Δa			Δb		
	Incisal	Central	Gingival	Incisal	Central	Gingival	Incisal	Central	Gingival	Incisal	Central	Gingival
	5,24	2,91	3,78	-4,95	0,02	1,06	0,25	-0,64	-1,47	1,70	-2,84	-3,32
1.1-2.1 by tooth section pre	ΔE			ΔL			Δa			Δb		
	Incisal	Central	Gingival	Incisal	Central	Gingival	Incisal	Central	Gingival	Incisal	Central	Gingival
	4,55	4,99	4,57	-1,77	3,46	2,22	0,15	-0,93	-1,46	1,11	-3,48	-3,72
1.1-2.1 by tooth section post	ΔE			ΔL			Δa			Δb		
	Incisal	Central	Gingival	Incisal	Central	Gingival	Incisal	Central	Gingival	Incisal	Central	Gingival
	1,02	3,51	1,23	3,18	3,44	1,16	-0,10	-0,29	0,01	-0,59	-0,64	-0,40

Results

We analyzed ΔE, ΔL*, Δa*, Δb* of each section of the affected tooth versus the simmetrical one before and after Icon® treatment, and the colourimetric variation of the one of the treated tooth (Table 1). A ΔE > 3.3 indicates a clearly detectable colour difference, ΔE between 3.3 and 1.1 indicates a colour difference existing but may be not detectable, while results < 1.1 indicates any visible difference for human eye perception. The colour was shifting from the affected to surrounding non-affected sound enamel as reported by Paris. Consistent with the finding of Paris et al. [11], in these cases the infiltrated lesions "took the appearance of the surrounding sound enamel".

Table 1 summarizes the colourimetric changes in 1.1 tooth colour after treatment and versus 2.1 that is supposed to be the simmetrical one not only by morphology but also by optical colourimetric properties. On 1.1 the defect is observed on the incisal section, and the aesthetic risolution presents a ΔE of 5,24 with a decrease in tooth lightness ΔL* -4.95, and an increase in Δa* 0.25 and Δb* 1.7.
1.1 versus 2.1: in the incisal section a ΔE of 4.55 is shown, and after treatment the ΔE decreases to 1.02.

Conclusions

Deep infiltration makes possible to treat all demineralized enamel lesions independently on their etiology or depth of the lesion. This overcomes the need of bleaching, fluoride or caseine phosphopeptide treatments, direct resin restorations or veneer, all treatments with poor prognosis when non invasive.

Resin infiltration represents the more important aspect of the procedure. The final infiltration is performed after a large number of cycles of sandblasting/milling and erosion, but never before a good outcome when dehydrated with ethanol.

This new technique appears promising, but more data are needed before its use can be recommended in all patients. Follow up to confirm colour stability remains necessary and it's essential to better define its clinical role.

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