Amelogenesis Imperfecta: A Non-Invasive Approach to Improve Esthetics in Young Patients. Report of Two Cases

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Objective–*Evaluate esthetic and functional efficacy of infiltrant resin (Icon, DMG, Hamburg, Germany) in Amelogenesis Imperfecta's treatment.* ***Study design****: Two adolescent patients, G.S. (13 years old) and C.M. (15 years old), affected by the hypomaturation type of Amelogenesis Imperfecta, were treated with Icon resin and were followed for twelve months.* ***Results****: Treated teeth show an excellent aesthetical result immediately after the resin application, effect that lasts in the long-term (six and twelve months follow-up examinations); the dental wear's progression seems to be clinically arrested.* ***Conclusions****: Resin infiltration has proven to be a minimal invasive treatment for dental discoloration, less aggressive than conventional procedures. This approach might be recommended for a stable esthetical improvement in moderate AI's lesions especially in children and adolescents.*

Key words: Amelogenesis Imperfecta, Icon, infiltrant resin, esthetics

INTRODUCTION

Enamel defects such as enamel hypoplasia and/or opacities may result from various disturbances during amelogenesis. *Amelogenesis imperfecta* (AI) is a group of hereditary conditions that affects the structure and appearance of enamel of both primary and permanent dentitions. This disorder is caused by mutations or altered expressions in five genes: AMEL (amelogenin), ENAM (enamelin), MMP20 (matrix metalloproteinaise-20), KLK4 (kallikrein-4) and FAM83H. The diversity of enamel defects, observed in AI, reflects the different timings throughout amelogenesis, in which the disturbances occur.[1]

A new model for classifying AI, based on four broad areas, was recently proposed: [2]

- Mode of inheritance: autosomal dominant, autosomal recessive, X-linked, isolated case;
- Molecular basis: chromosomal localisation/locus/mutation;
- Biochemical outcome: putative result of mutation when known;
- Phenotype: hypoplastic, hypocalcified, hypomaturation, hypomaturation/hypoplastic with taurodontism.

Affected teeth show hypomineralization and demarcated enamel opacities, ranging from white to brown, according to the severity of the disease; hypoplasia can also be associated.[3] The hypomaturation type of AI, in particular, is characterized by opaque white discoloration, chipped surface, less hardness and a chalky appearance.[4,5]

Dental signs and symptoms of this disorder are:

- Poor aesthetics and discolorations: several psychosocial issues are linked to this disorder; patients often express a high level of concern regarding enamel appearance and a lower self-esteem, which might significantly affect their overall quality of life;[6,7]
- Hypersensitivity: dental sensitivity, present from early childhood, may affect oral hygiene habits, increasing susceptibility to caries, gingivitis and periodontal disease;[7,8]
- Fragile enamel: soft and porous enamel causes a rapid wear and a loss of dental tissue, producing occlusal dysfunctions such as reduction of the vertical dimension.

To date, microabrasion, fluoride varnish and Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP) applications are the treatments of choice to solve the complications caused by mild/moderate AI.[9,10] Enamel microabrasion involves the usage of

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acidic and abrasive agents on the affected enamel surface, such as 37% phosphoric acid with pumice or 6% hydrochloric acid with silica.[9] Fluoride varnishes and CPP-ACP are used in order to reduce demineralization and enhance enamel remineralization.[10] However, these treatments require repeated applications and do not give fully satisfactory aesthetical results. A conservative and/or prosthetic approach (such as veneers or crown depending on the area), for teeth affected by serious AI, is mandatory in order to improve aesthetical and functional conditions.[11,12]

Early detection and careful treatment planning are key elements for a successful outcome.[1]

Recently, a new conservative approach to face enamel defects was introduced: the infiltrant resin Icon (DMG, Hamburg, Germany). This is a non-filled low-viscosity resin that has been proposed with the aim of arresting demineralization progression in hard dental tissues, especially in lesions produced by bacterial acids. The resin is able to flow into the enamel porosity, hardening the tissue and improving aesthetics.[13]

MATERIALS AND METHOD

In this report, two cases of enamel opacities in adolescent patients affected by moderate *Amelogenesis imperfecta* (hypomatured phenotype) are analyzed. Both cases were treated using Icon Resin approach.

In the two cases, all teeth, in particular superior central incisors, show diffuse and demarcated white opacities, especially located on the incisal half of the buccal surfaces (Figures 1a and 2a).

Pictures of teeth, before, during and after the treatment, were captured using a digital camera designed for intra-oral photography (Nikon D3300 with a 105 mm macro lens) at magnifications 1:2 and 1:1 with an automatic flash. Afterwards, these pictures were edited using an imaging software (iPhoto, Apple, CA, USA) in order to enhance the visualization of opacities and defects (Figures 3 and 4).

Case A

A 13 years old girl (G.S.), affected by moderate AI (hypomatured type), was treated using Icon resin protocol, after the patient and parents signed an informed consent.

Teeth were cleaned using a prophylaxis paste (Proxyt, RDA 7, Ivoclar, Vivadent AG, Schaan, Liechtenstein) and any cleaning residue was removed with water spray (Fig 5a). Teeth from the second right premolar to the second left premolar of the upper jaw were isolated with a rubber dam (Figure 5b) and buccal surfaces were prepared applying 15% HCl gel (Icon-Etch) for 2 minutes in order to open the pore system of the enamel (Figure 5c). Afterwards, the gel was rinsed with water for 30 seconds and the teeth were air-dried (Figure 5d). Icon-Dry was then applied and subsequently left for 30 seconds to dehydrate the enamel surface; teeth were air-dried once again. A second application of the HCl gel on the whole buccal surfaces was performed, followed by a third application only on the white demarcated lesions of the central incisors, since lesions were not fully etched after the second application of the gel. Icon-Infiltrant was applied and left on the whole buccal surfaces for 3 minutes (Figure 5e), light-cured for 40 seconds, applied a second time for 1 minute and light-cured again (Figure 5f). Finally, surfaces were polished using silicone points (SHOFU DENTAL GmbH, Ratingen, Germany) (Figure 5g).

Case B

A 15 years old boy (C.M.) affected by moderate AI (hypomatured type), was treated using Icon resin protocol, after the patient and parents signed an informed consent.

The patient both complained on the white opacities and on the teeth's yellowish discoloration; it was decided to bleach the teeth before proceeding with the Icon treatment.

At the first appointment, the bleaching protocol was applied (Figure 2b): teeth were isolated with a rubber dam and enamel defects were covered with a liquid dam to avoid their further whitening and

Figure 1. G.S. (a) She presents white opacities especially located on the incisal half of the central incisors' buccal surfaces. (b) Immediately after resin infiltration. (c) Six-month follow up. (d) Twelve-month follow up.

Figure 2. C.M. (a) He presents white opacities on all upper teeth. Signs of pathological tooth wear are evident in the incisal area of incisors. (b) Immediately after bleaching. (c) Immediately after resin infiltration. (d) Six-month follow up. (e) Twelve-month follow up.

a Philips Zoom WhiteSpeed Light-Activated Whitening System was used (3 applications of 15 minutes each in one sitting).

After 1-week, the Icon resin protocol was carried out: the same procedure described above was used again, except for HCl gel that was applied only two times on the whole buccal surfaces.

Both cases were followed-up on the sixth and twelfth months. Pictures were taken following the same procedures described above.

RESULTS

In *Case A* an almost complete disappearance of the defects was recorded (Figure 1b), showing a homogeneous color of the teeth. In *Case B*, analogous results were obtained: a brighter dental appearance was evident, due to the bleaching treatment followed by Icon protocol (Figure 2c).

Figure 3. G.S. (a) Before treatment. (b) Immediately after resin infiltration. (c) Six-month follow-up. (d) Twelve-month follow up.

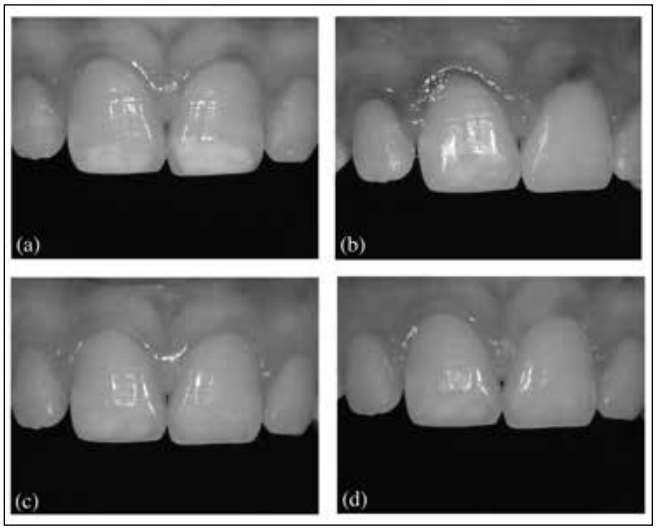
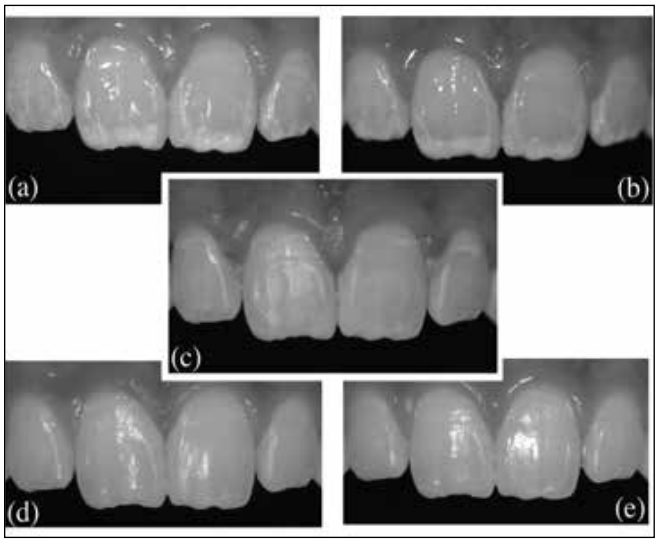


Figure 4. C.M. (a) Before treatment. (b) After bleaching. (c) Immediately after resin infiltration. (d) Six-month follow up. (e) Twelve-month follow up.



DISCUSSION

Amelogenesis imperfecta has a prevalence range from 1:700 to 1:14,000.[12]

Clinical signs and symptoms associated with AI include functional problems, sensitivity and aesthetic discomfort. The treatment options for affected teeth are broad, ranging from remineralization to prosthetic treatment. In order to preserve enamel integrity in mild/moderate AI forms, a non-invasive treatment is desirable especially for children and adolescents. Remineralization procedures require an extensive patient's compliance and do not completely solve the opaque appearance. However, the protocol proposed in this report has shown to be effective in improving dental aesthetic, without requiring any patient collaboration at home.

The present report shows that an excellent aesthetical result may be achieved using resin infiltration, without mechanical dental tissue's removal. In this way, not only the patient's aesthetics is

Figure 5. G.S. Different phases of the resin infiltration treatment.

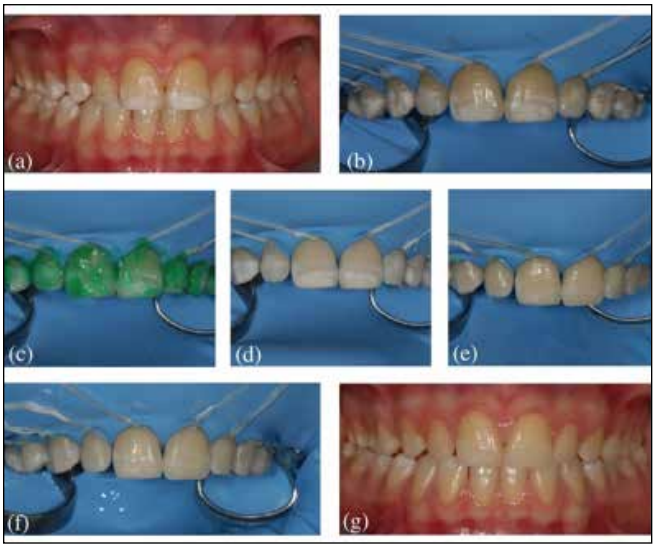


Figure 6. C.M. Overlaying of pictures taken before treatment and at 12-month follow-up, which shows the stability of the incisal edge of the upper incisors.

improved, but also teeth wears seem to be clinically arrested. At the six-month (Figures 1c and 2d) and twelve-month follow-up examinations (Figures 1d and 2e), a clear aesthetical improvement, without clinical evidence of a further loss of dental tissue (Figure 6), has been shown. Furthermore, the resin infiltration technique was appreciated by the young patients due to its rapidness (one application) and by parents due to the affordable price.

This report demonstrates that resin infiltration is a more valuable option for this type of dental discoloration, in comparison to more invasive, conventional procedures;[14] the method can be recommended for aesthetical improvements of moderate AI's lesions with stable results.[15,16] In a recent report, infiltrant resin was applied on fluorosis stain and on defects related to traumatic dental injury. While fluorosis stains showed a significant improvement in the appearance and color uniformity of teeth, stains due to dental trauma were not completely blended.[17]

The use of bleaching systems on hypomineralized teeth is not recommended because might cause mineral changes due to peroxides.[10] During a bleaching treatment, in fact, peroxides initiate an oxide-reduction reaction that may lead to the dissolution of both the organic and the inorganic matrices, usually repaired thanks to saliva's remineralization properties. Peroxides' effect on enamel defects, however, might increase enamel's porosity, irregularities of the surface, roughness, and a decrease in hardness.[10] However, if enamel defects are covered during bleaching, preventing peroxides' contact, the risk of tissue damage is reduced and enamel's appearance, after Icon procedure, is more aesthetically pleasing.

The resin infiltration technique, compared to a remineralization procedure, that requires multiple applications, can be defined as more successful since has shown better aesthetical results in only one application, especially for adolescents who are not always able to offer a long-term compliance.

CONCLUSIONS

Resin infiltration has proven to be a minimal invasive possible treatment for dental discoloration, less aggressive than conventional procedures. This approach might be recommended for a stable aesthetical improvement in moderate AI's lesions especially in children and adolescents.

The short follow-up period (twelve months) might represent a limit of this report. Aesthetical results, in fact, seem to be stable, however, in order to verify the treatment's long-lasting effect, a longer follow-up period could have been carried out. In addition, since this is the first time that Icon infiltrant resin has been used to treat enamel discoloration caused by moderate *Amelogenesis imperfecta,* further revisions of the protocol might be necessary in the next future.

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