

Natural Layering Concept in the Treatment of Developmental Defect of Enamelin Adolescent Patient

Vera Yulina¹, Meirina Gartika²

^{1,2}Department of Pediatric Dentistry, Faculty of Dentistry, Universitas Padjadjaran
Address: Jalan Sekeloa Selatan No. 1 Bandung 40132 Indonesia, Phone: +62811204863,
*Corresponding Author: Meirina Gartika

ABSTRACT: The developmental defect of enamel (DDE) is a deviation in the quality and quantity of tooth enamel caused by a disruption in the enamel matrix secretion during the mineralization or maturation process. Enamel defects that occur in the anterior teeth can interfere with the aesthetical aspect, reducing the level of confidence, especially in adolescents. There are several options for treating the enamel defects, including microabrasion, bleaching, direct restoration, indirect restoration, or combination of these treatments. Severity of the defect and the age of the patient are one of the concerning factors when determining a treatment plan. The purpose of this journal was to report the case of an enamel defect that occurs in the anterior teeth of a teenage patient who performed composite resin restoration treatment with the Natural Layering Concept approach so that the restorations results will resemble the natural teeth.

Keywords: Developmental Defect of Enamel (DDE), Natural Layering Concept.

I. INTRODUCTION

There are many factors that can affect the aesthetical aspect in Dentistry. Developmental defect of enamel (DDE) is a case often found in clinical practice. Enamel defect is a deviation in the quality and quantity of tooth enamel caused by a disruption in the enamel matrix secretion during the mineralization or maturation process.¹⁻⁴ The severity of defects usually depends on the development stage, time and duration.⁵⁻⁶ Some aesthetic dental procedures and invasive treatments in pediatric and adolescent patients must sometimes be avoided. Therefore, direct restoration with composite resins on enamel defects, especially anterior teeth, has become a more conservative choice related to mechanical, aesthetical, and functional properties. Along with the development of technology, a new, artistic, and natural approach on composite resin restorations has been developed for anterior tooth restoration, namely the natural layering concept.⁷⁻¹²

II. CASE REPORT

A 12-year-old female patient, came to the Department of Pediatric Dentistry of Universitas Padjadjaran Dental Hospital (RSGM Unpad). The patient was complaining about the white spots on her maxillary and mandibular anterior teeth, which has become a significant disturbance for her. The patient feels embarrassed by the condition of her teeth and feeling insecure when she smiles and speaks. From the patient's history known that the white spot has existed since the patient's teeth erupted. The patient was also have been hospitalised at the age of 7-years-old due to a urinary tract infection. Also, the patient's parents were informing us that the patient's anterior teeth had a blackish colour. Intraoral clinical examination showed a DDE in the anterior teeth of both jaw arches (Fig. 1). To confirm the depth of the defect, a transillumination test was performed by irradiating the teeth from the palatal surface with a halogen source or LED.



Figure 1. Intraoral Clinical Feature of Patient Before Treatment

The first step of the treatment was oral prophylaxis to remove debris and plaque using a low-speed brush (Fig.2A). Subsequently, preparations for teeth number 13, 12, 11, 21, 22, and 23 was performed using a high-speed diamond bur fissure to remove the outermost surface of the enamel to reduce the discolouration due to enamel defects and providing a place for the restoration material (Fig.2B).



**Figure 2. A. Oral prophylaxis to remove debris and plaque;
B. Preparation of the outermost surface of the enamel using a fissure diamond bur.**

The next step was to perform an etching (Magnum, Etching Gel, 37% Phosphoric Acid) for 15 seconds on the enamel surface to form the microporosity (Fig.3A), then the teeth were rinsed and dried. Right after, was the application of the 3M-ESPE Single Bond Universal RF Vial, then polymerised with a light curing unit for 10 seconds (Fig.3B).



Figure 3. A. Etching application for 15 seconds to form microporosity on the enamel surface; B. Bonding agent application and polymerisation for 10 seconds.

Due to the yellowish-white colour of the enamel defect, it was decided to use the flowable composite resin with the A1 (3M-ESPE Composite Z350 XT Flow) colour as the base layer of the restoration material to remove the yellowish colour of the teeth (Fig. 4A). After flattening the entire teeth surface by following the natural shape of the enamel surface, the polymerisation was performed for 20 seconds. The next application stage in the natural layering concept restoration was to put the A2Body colour composite resin restoration material (Z350 XT Universal Restorative A2 Body 3M ESPE) using a composite plastic filling instrument (Fig. 4B).

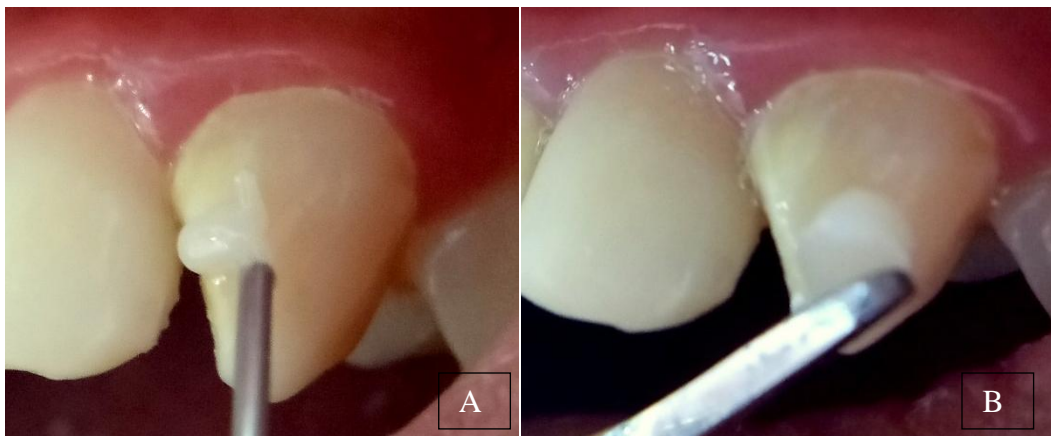


Figure 4. A. Application of flowable composite resin with A1 colour; B. Application of composite resin with A2Body colour using the composite plastic filling instrument.

A special brush (Estelite Omega Brush No.24, Tokuyama America Inc.) was used to flatten the restoration material then polymerised for 20 seconds. In addition to the flattening, the same brush was used to bring the composite to the incisal part and form the enamel characteristics to make a natural appearance (Fig. 5A). The final step was to place a composite resin restoration material with an enamel-similar colour (Filtek Z350 XT Universal Restorative A2 Enamel 3M-ESPE). After the restoration of six anterior teeth, the polish was performed using a low-speed polishing disc (Sof-Lex contouring and polishing disc 3M-ESPE), starting from darker towards the lighter colour discs. The darker the colour of the disc, the higher the roughness level (Fig. 5B-5D).

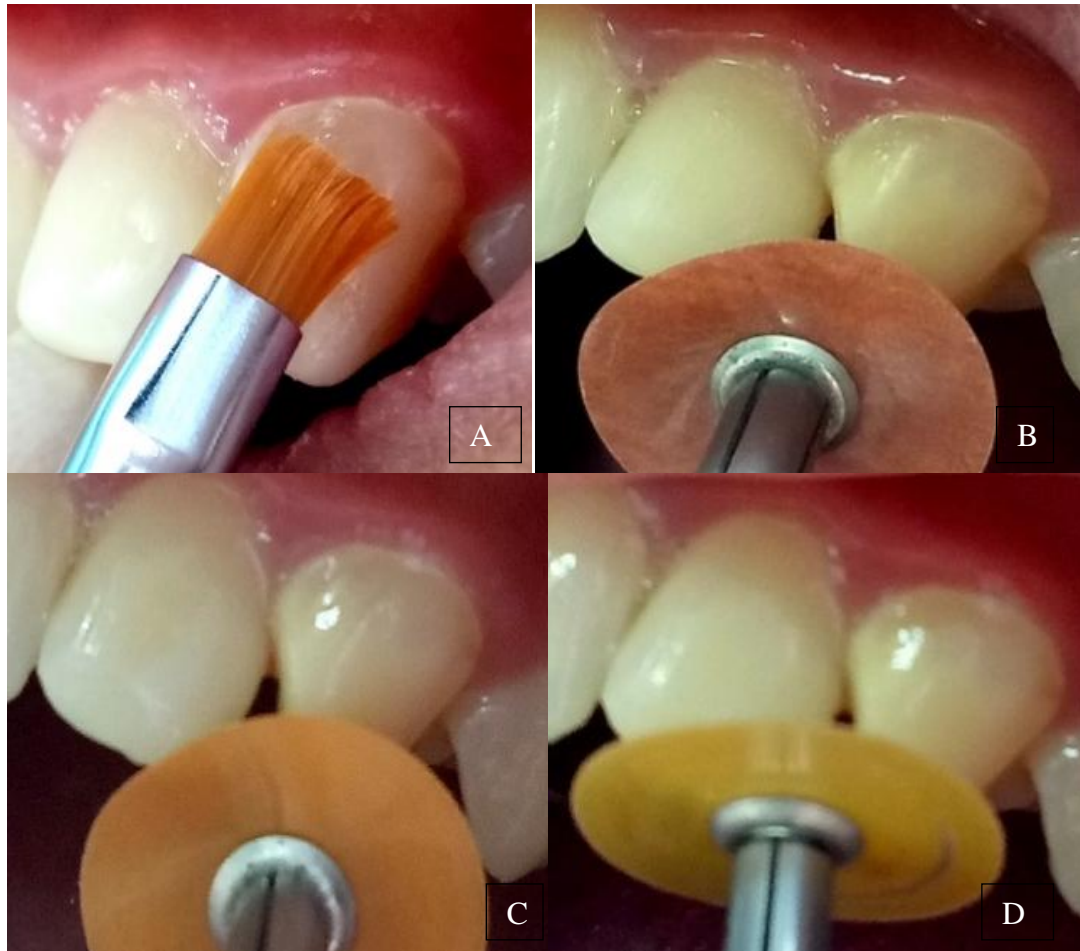


Figure 5. A. The restoration material was flattened with a special brush while forming the characteristics of the enamel surface; B, C, and D. Polishing process with discs to remove excess composite resin, forming and smoothing the restored tooth surface.

The final polishing process was performed by using the Eve Diacomp Twist Composite Polisher at low speed to achieve a glistening and natural restoration results (Fig. 6A and 6B). Fig. 6C shows a clinical feature of the same six maxillary anterior teeth after being restored with a natural layering concept approach.



Figure 6. A and B. The final stage polishing to obtain more natural results. C. Clinical feature after restoration with Natural Layering Concept approach.

III. DISCUSSION

This case report was related to the Developmental Defect of Enamel (DDE) occurred in the permanent anterior teeth of both jaw arches. Enamel defect is a disruption of the process of apposition and mineralisation in the enamel and can cause manifestations in the form of enamel hypoplasia or enamel opacity.^{6,13} Disruptions of the enamel development can be occurred due to genetic, systemic, local, environmental factors, or other factors. Various bacterial and viral infectious diseases such as urinary tract infections, otitis, and upper respiratory tract diseases are related to DDE. As in patients in this case who have had a history of urinary tract infections at the age of 7-years-old. Local factors such as trauma and infection are also associated with enamel hypoplasia in the traumatised or infected teeth, in contrast with the systemic factors that commonly involve all developing teeth in the jaw arches.¹⁴⁻¹⁶

In addition of having a urinary tract infection, from anamnesis performed towards the patient's parents was known that the primary anterior teeth of the patient were blackish and was estimated as an Early Childhood Caries (ECC) condition. This condition was consistent with a cohort study conducted by Targino et al.¹⁷ who reported that there was a relationship between ECC and enamel defects that occur in the permanent teeth. Other studies conducted by Li and Seow¹⁸ also reported the same result, which was the majority of enamel opacities occurred in the gingival area where the first defected enamel was found on the buccal surface. This study concluded that this condition was caused by a disruption of the calcification process occurring at the final mineralisation stage.

Various treatment protocols for enamel defects have been published, depending on the involvement and severity level of the lesion. Usually, the treatment approach consists of enamel microabrasion, conservative aesthetic restoration, and bleaching.¹⁹ In this case, the transillumination test result showed that the defect was deep thus was decided to be treated using a direct restoration with adhesive composite resin. This condition was similar to a study conducted by Carvalho et al.¹ suggested that lesions involving enamel and dentine, with or without the loss of enamel structure were indicated for direct restoration. The age of the patient is an important factor that must be considered when determining the treatment of DDE. In this case, the patient is a 12-years-old teenager. According to Carvalho et al.¹, invasive treatment should be avoided especially for children. However, when aesthetic disorders had disturbed the children's social life, it is indicated that a very conservative restoration treatment is possible. Therefore, in this case, the chosen treatment was a direct restoration with a composite resin material.²⁰

Dietschi et al.¹⁰ have introduced the concept of composite resin restoration with the ultimate goal of creating a restoration resemble the natural teeth. This concept is known as the Natural Layering Concept.¹¹⁻¹² There were two basic stages. The first stage was the selection of the dentine colour in the cervical area, which has thinner enamel. The second stage was the selection of the enamel colour which was usually performed by visual observation. The application of this concept was also carried out by Hatkar⁸ and Fahl⁹ in their case report. The natural colour characteristics of the teeth can be produced through the colour effects, giving the translucent effect at the incisal edges which generally resembles blue or grey. Carvalho¹ reported that the critical thing to be considered was that the thickness of the enamel composite resin must be thinner than the enamel of the original tooth, to prevent a reduction in the restoration colour. A thicker enamel composite resin layer will produce a darker restoration colour due to differences in the refractive index between the resin and the original tooth. Therefore, every stage of treatment (diagnosis, plan, and management) is an essential thing for obtaining the perfect results.

IV. CONCLUSION

Direct restoration using the composite resin with the Natural Layering Concept approach was proven to be able to improve the appearance and aesthetics of teeth with Developmental Defect of Enamel (DDE) thus also improving the patient's level of confidence, psychological, and social life. The appropriate diagnosis was needed regarding the depth of the lesion to determine the treatment plan success.

REFERENCES

- [1]. Carvalho LD, Bernardon JK, Bruzi G, Andrada MA, Vieira LC. Hypoplastic Enamel Treatment in Permanent Anterior Teeth of a Child. *Oper Dent*. 2013; 38(4): 363–8. DOI: [10.2341/12-284-T](https://doi.org/10.2341/12-284-T)
- [2]. Simmer JP, Hu JC. Dental Enamel Formation and Its Impact on Clinical Dentistry. *J Dent Educ*. 2001; 65(9): 896–905.
- [3]. Elcock C, Smith RN, Simpson J, Abdellatif A, Backman B, Brook AH. Comparison of Methods for Measurement of Hypoplastic Lesions. *Eur J Oral Sci*. 2006; 114(Suppl 1): 365–9. DOI: [10.1111/j.1600-0722.2006.00316.x](https://doi.org/10.1111/j.1600-0722.2006.00316.x)
- [4]. Witzel C, Kierdorf U, Schultz M, Kierdorf H. Insights from the inside: histological analysis of abnormal enamel microstructure associated with hypoplastic enamel defect in human teeth. *Am J Phys Anthropol*. 2008; 136(4): 400–14. DOI: [10.1002/ajpa.20822](https://doi.org/10.1002/ajpa.20822)

- [5]. Bernardon JK, Gondo R, Baratieri LN. Minimally Invasive Restorative Treatment of Hypoplastic Enamel in Anterior Teeth. *Am J Esthet Dent*. 2011; 1(1): 10–24.
- [6]. Salanitri S, Seow WK. Developmental enamel defects in the primary dentition :aetiology and clinical management. *Aust Dent J*. 2013; 58(2): 133–40. DOI: [10.1111/adj.12039](https://doi.org/10.1111/adj.12039)
- [7]. Nahsan FP, Mondelli FR, Franco EB, Naufel FS, Ueda JK, Schmitt VL, et al. Clinical strategies for esthetic excellence in anterior tooth restorations: understanding color and composite resin selection. *J Appl Oral Sci*. 2012; 20(2): 151–6.
- [8]. Hatkar P. Preserving Natural Tooth Structure with Composite Resin. *J Cosmet Dent*. 2010; 26(3): 26–36.
- [9]. Fahl N Jr. Step-by-Step Approaches for Anterior Direct Restorative Challenges. *J Cosmet Dent*. 2011; 26(4): 42–55.
- [10]. Dietschi D. Clinical Application of the “Natural Layering Concept”. *Oral Health*. 2010; 97(8): 69.
- [11]. Dietschi D, Ardu S, Krejci I. A new shading concept based on natural tooth color applied to direct composite restorations. *Quintessence Int*. 2006; 37(2): 91–102.
- [12]. Dietschi D, Fahl N Jr. Shading concepts and layering techniques to master direct anterior composite restorations : an update. *Br Dent J*. 2016; 221(12): 765–71. DOI: [10.1038/sj.bdj.2016.944](https://doi.org/10.1038/sj.bdj.2016.944)
- [13]. Fontana M. QUEST Enamel Hypoplasia. [Presentation] QUEST Symposium on Caries in AI/AN Children. August 21–22, 2015.
- [14]. Pocket Dentistry. Espelid I, Haubek D, Jalevik B. Developmental Defect of the Dental Hard Tissue and their Treatment. Available from: <https://pocketdentistry.com/20-developmental-defects-of-the-dental-hard-tissues-and-their-treatment/> [Accessed November 3, 2018].
- [15]. Dabiri D, Eckert GJ, Li Y, Seow K, Schroth RJ, Warren J, et al. Diagnosing Developmental Defects of Enamel : Pilot Study of Online Training and Accuracy. *Pediatr Dent*. 2018; 40(2): 105–9.
- [16]. Jacobsen PE, Henriksen TB, Haubek D, Østergaard JR. Developmental Enamel Defects in Children Prenatally Exposed to Anti-Epileptic Drugs. *PLoS One*. 2013; 8(3): e58213. DOI: [10.1371/journal.pone.0058213](https://doi.org/10.1371/journal.pone.0058213)
- [17]. Targino AG, Rosenblatt A, Oliveira AF, Chaves AM, Santos VE. The relationship of enamel defects and caries : a cohort study. *Oral Dis*. 2011; 17(4): 420–6. DOI: [10.1111/j.1601-0825.2010.01770.x](https://doi.org/10.1111/j.1601-0825.2010.01770.x)
- [18]. Seow WK. Developmental defects of enamel and dentine : challenges for basic science research and clinical management. *Aust Dent J*. 2014; 59(Suppl 1): 143–54. DOI: [10.1111/adj.12104](https://doi.org/10.1111/adj.12104)
- [19]. Martos J, Gewehr A, Paim E. Aesthetic approach for anterior teeth with enamel hypoplasia. *ContempClin Dent*. 2012; 3(Suppl 1): 82–5. DOI: [10.4103/0976-237X.95112](https://doi.org/10.4103/0976-237X.95112)
- [20]. Vieira KO, Garcia FCP, Nolasco GMC, Gonzaga CC, Roseira PM, Teixeira FD, et al.. Microabrasion and composite resin for re-establishing smile esthetics: a case report. *Rev Sul-bras Odontol*. 2015; 12(4): 383–8

***Corresponding Author: Meirina Gartika,**

²Department of Pediatric Dentistry, Faculty of Dentistry, Universitas Padjadjaran