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High viscosity glass ionomer cement for rehabilitation in dentinogenesis imperfecta – clinical case report

Paula Karine Jorge[1]*, Luciana Lourenço Ribeiro Vitor[2], Mariel Tavares Oliveira Prado Bergamo[3], Eloá Cristina Passucci Ambrosio[1], Simone Soares[4], Thais Marchini de Oliveira[5], Maria Fidela de Lima Navarro[6], Daniela Rios[5]

[1] Hospital for Rehabilitation of Craniofacial Anomalies, University of São Paulo, Bauru, São Paulo, Brazil.

[2] Sacred Heart University Center, Bauru, São Paulo, Brasil.

[3] Department of Cariology, Restorative Sciences, Endodontics, School of Dentistry, University of Michigan, Ann Arbor, Michigan, United States of America.

[4] Department of Prosthodontics and Periodontics, Bauru School of Dentistry, Hospital for Rehabilitation of Craniofacial Anomalies, University of São Paulo, Bauru, São Paulo, Brazil.

[5] Department of Pediatric Dentistry, Orthodontics and Public Heath, Bauru School of Dentistry, Hospital for Rehabilitation of Craniofacial Anomalies, University of São Paulo, Bauru, São Paulo, Brazil.

[6] Department of Restorative Dentistry, Endodontics, and Dental Materials, Bauru School of Dentistry, University of São Paulo, Bauru, São Paulo, Brazil.

Corresponding author:
Paula Karine Jorge
Rua Silvio Marchione, 3-20 -
Vila Nova Cidade Universitária.
17012-900 Bauru - SP, Brasil.
jorgepk@usp.br

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Aim: This study aimed to report the use of high-viscosity glass ionomer cement for functional and esthetical rehabilitation of a 6-year-old boy with DGI-II. Methods: Using a working cast, templates for all teeth requiring restoration were made and used to make an addition silicon replica. With the aid of the silicone templates, all primary teeth with weariness and the permanent molars newly erupted were respectively restored and covered with high-viscosity glass ionomer cement (GIC). **Results:** Following-up of 12 months were made. The early diagnosis and treatment of teeth with DGI-II play an essential role in the dental preservation and child's functional, esthetical and psychological aspects. **Conclusion:** In this case report, the boy changed his shy behavior to a more communicative one, came back to smile besides being able to eat normally again, impacting his quality of life. The rehabilitation with replica technique and high-viscosity glass ionomer cement can save chair time, because DGI-II is a condition that needs continuous return to the dentist regarding challenging adherence of any adhesive restoration materials.

Keywords: Dentinogenesis imperfecta. Child. Glass ionomer cements. Mouth rehabilitation.

Introduction

Dentinogenesis imperfecta (DGI) is an inheritable dental anomaly both in primary and permanent dentition with incidence of 1:6000 to 1:8000[1-4]. According to Shields[5,6], DGI is classified into three types: type I – associated with osteogenesis imperfecta (DGI-I, OMIM #125490), type II - hereditary opalescent dentin, not associated with bone defect (DGI-II, OMIM #125490), and type III - Brandywine isolate opalescent dentin (DGI-III, OMIM #125500).

DGI-II is an autosomal dominant condition with almost 100% of penetrance, similarly affecting the primary and permanent dentition[2,4]. The etiology is a mutation in loci 4q22.1 of dentin sialophosphoprotein gene (DSPP), which affects the dentin during the histodifferentiation stage of the tooth bud[2,7,8]. DSPP gene encodes two proteins: dentin sialoprotein (DSP) and dentin phosphoprotein (DPP)[4]. DPP controls the process of dentin mineralization[7]. The failure in DPP results in a structural or regulatory protein defect in dentinal formation[4,9]. Consequently, the dentin is poorly mineralized and prone to more severe weariness[2,3,10-12]. Under occlusal stress, the enamel breaks because of the alteration in enamel-dentin junction[9,11,13].

Histologically, the literature reports fewer more obliterated dentinal tubules with an irregular structural form[3,14,15], resulting in pulp obliteration[2,9,15]. Because of that, clinically, the teeth have bell-shaped crowns[7] with colors ranging from greyish blue to yellow and brown[2,3,15]. The literature also evidenced the tooth weariness ranging from minimal loss to marked weariness leading to the total loss of the crown up to the gingival level[7]. Despite the marked tooth weariness, the dentin has a hard glassy appearance because of the dentinal sclerosis, and dentinal sensitivity is not reported[16,17]. Radiographically, the roots, pulp chamber, and root canals are smaller (OMIM125480). Pulp chamber and canals are characteristically obliterated[2,14].

DGI-II early diagnosis and treatment goal is to protect the tooth against the weariness, restore the function and esthetics of the affected teeth, prevent premature tooth loss, and maintain proper oral health[3,7,18,19]. For this treatment it can be used restorative materials as glass ionomer and composite resin. Thus, this study aimed to report a functional and esthetical rehabilitation of a 6-year-old boy with DGI-II using a simplified occlusal replica adapted technique with high-viscosity glass ionomer cement[20].

Clinical Report Case

A 6-year-old boy was referred to the Institution's Pediatric Dentistry Clinics (Bauru School of Dentistry, University of São Paulo) due to weariness of the primary teeth. The informed consent form was signed by the patient's legal guardian. The parents' chief complaint was the failure of the previous restorative treatments and that the "boy did not smile and couldn't eat hard solid foods". The mother reported that the teeth worn as the boy grew-up and several restorative treatments had been performed, which did not last for more than 2 weeks. The mother declared lack of systemic diseases, good general health, and no familial history of dental anomalies.

The extraoral and intraoral examination revealed a decreased vertical dimension (Figure 1 and 2). The intraoral examination showed a brownish amber color of the primary teeth and greyish blue of the permanent teeth (Figure 3). The right and left primary second molars exhibited coronal pulp exposure with fistula (Figure 4). All primary teeth exhibited moderate-to-marked tooth weariness.

Figure 1. Extraoral examination.

Figure 2. Intraoral photograph which shows decreased vertical dimension.

Figure 3. Brownish amber color of the primary teeth and greyish blue of the permanent teeth.

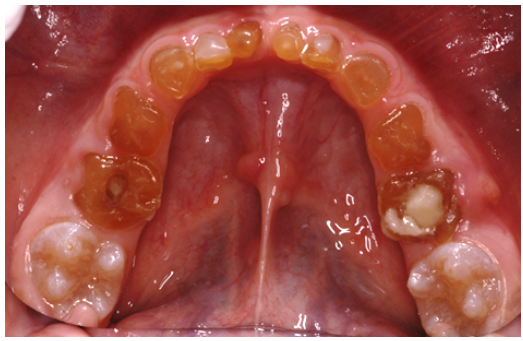

Figure 4. Right and left inferior primary second molars exhibited coronal pulp exposure with fistula.

Figure 5. Overview of panoramic radiograph.

The panoramic radiographic revealed the presence of all primary teeth with general aspect of obliterated pulp chambers and roots (Figure 5). All permanent teeth were present, except for the third molars. The periapical radiographs of the right primary lateral incisor, right and left primary second molars showed an atresic pulp. Also, the furcal and apical areas of the right and left lateral and central incisors and right and left primary second molars showed a radiolucent aspect.

Based on the medical and dental history, clinical and radiographic conditions mentioned above, the boy was diagnosis with dentinogenesis imperfecta type II. The proposed treatment planning comprised the extraction of the right and left lateral and central incisors and right and left primary second molars followed by restoration with high-viscosity glass ionomer cement (GIC) to rehabilitate the function and esthetics of the primary teeth and prevent the weariness of the permanent first molars.

All procedures were explained in detail and the parents read and signed a free and clarified consent form. First, to enable the proper oral health, the right and left lateral and central incisors and right and left primary second molars were extracted because of the furcal and apical radiolucent areas suggestive of pulp infection. All extraction procedures were performed uneventfully.

For the restoration procedures a technique that consist of a simplified occlusal replica adapted technique with high-viscosity GIC[20] was used. For that, prior to the restoration of the primary and permanent teeth, an impression of the maxillary and mandibular arch was performed to obtain a working cast (Figure 6). On the working cast, templates for all teeth requiring restoration were constructed with addition silicon (Express™ XT Putty Soft, 3M ESPE). With the aid of the silicone templates, all primary teeth with weariness and the permanent molars were respectively restored and covered with high-viscosity GIC (Equia Forte®, GC, Leuven, Belgium). First, the permanent teeth, newly erupted, were covered, and in the subsequent appointments, the primary teeth were restored.

Figure 6. Mandibular working model with molds made with addition silicone used in restorative procedures with high-viscosity glass ionomer cement.

The sequence of the restoration/covering procedures with the silicone device were: prophylaxis, relative isolation, application of Equia conditioner for 20 seconds, washing, gentle air drying. Then, the material capsule was mixed according to the manufacturer's instructions (Equia Forte®, GC, Leuven, Belgium) and the addition silicone impression was filled with it, positioned on the tooth, and pressed for the GIC setting time of 2.5 minutes[20]. After the material setting, the excess was gently removed and Equia coating was applied and light-cured for 20 seconds[21], avoiding syneresis and imbibition (Figure 7). All finishing and polishing procedures were executed one week after the restorative procedures. After all restorative procedures, a removable space maintainer was installed.

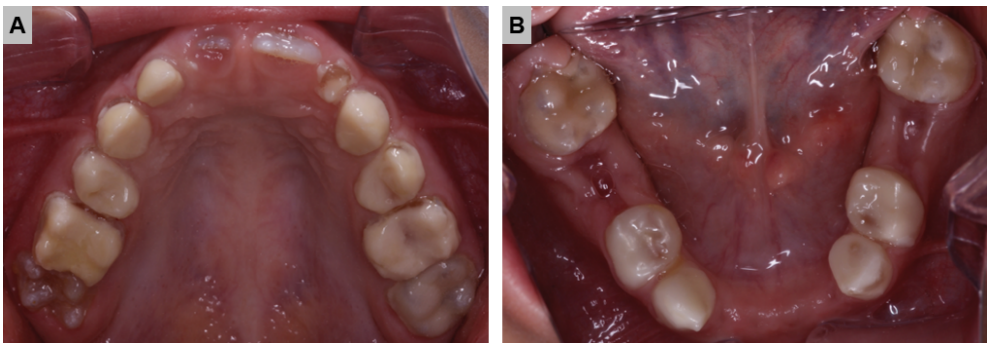

Figure 7. Restorative procedures completed in the maxilla (A) and mandible (B).

The boy was followed-up at every 3 months. At 3-month following-up appointment, the mother reported a marked improvement in the boy's psychological behavior. She revealed that he was smiling and eating hard solid foods again, and that the teacher observed that he was interacting more with the other students, besides some rebuilt dental elements had failed (Figure 8). Overtime, the right and left maxillary and mandibular incisors erupted. At 9-month following-up appointment, the right and left primary canines had to be extracted, because of anterior inferior tooth crowding, which resulted in loss of anchorage of the space maintainer. The 12-month clinical following-up showed the loss of the high-viscosity CIV restoration in the primary teeth with more exposed dentin and the satisfactory adhesion of this material on the permanent molars (Figure 9).

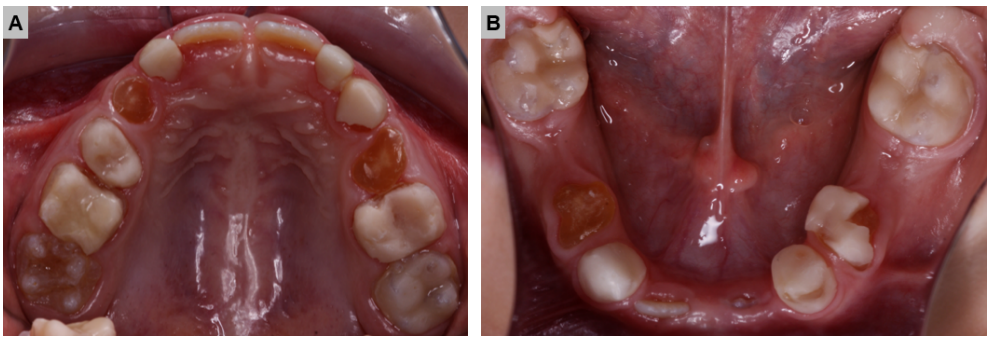

Figure 8. Restorative procedures in the maxilla (A) and mandible (B) after 3 months.

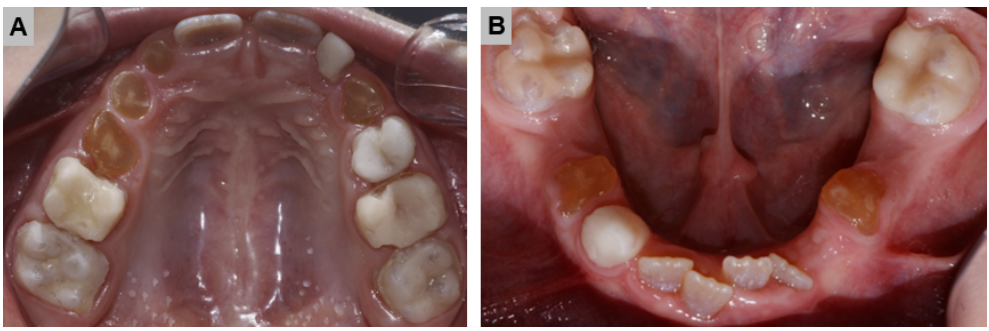

Figure 9. Restorative procedures in the maxilla (A) and mandible (B) at 12 months.

Discussion

Dentinogenesis imperfecta type II was diagnosed based on the clinical and radiographic signs of opalescent teeth with glassy dentin, narrower and obliterated root canals with no signs of bone problems (OMIM #125490), as the mother reported general good health. The boy had two other siblings and neither the siblings nor the parents had dental anomalies. DGI-II has a dominant autosomal inheritance, that is, every individual with a mutation in the dentin sialophosphoprotein gene will show the

phenotype (OMIM #125490). Genetic counselling is advisable because of the inheritable genetic condition[22].

Despite of the pulp obliteration of all teeth in individuals with DGI-II, most of the pulp tissues remain vital[23]. However, in these individuals, endodontic treatment is contra-indicated in cases of pulp abscesses and root resorptions because the lack of a well-delimited root canal and dentin obliterations, which would lead to failures[7,23,24]. Thus, in this cases report, we planned to extract the teeth with radiographic signs suggestive of pulp pathology. The extraction procedures occurred uneventfully, and a space maintainer was installed to prevent loss of the space of the primary molars.

Among the benefits of using the silicone guide technique is the reduction of the patient's time in the chair. Because it is a quick procedure, it does not cause discomfort and does not require the patient to wait a long time for the process to be completed. The maintaining of the silicone matrix in position during the initial setting time of the cement guaranteed the isolation of the restored surface from oral fluids, allowing the material to achieve its adequate properties[20]. The favorable characteristics of glass ionomer cement make them an advantage and choice for their use; they are the release of fluoride (anti-cariogenic action), good adhesion to tooth structure; the coefficient of thermal expansion of glass ionomer is low and close to tooth structure values. Moreover, for this technique conventional glass ionomer was the most suitable material to use. The restoration with high-viscosity GIC aimed to the early preventive treatment of the permanent molars and the restorative treatment of the primary teeth to achieve a function and esthetic outcome. In the permanent teeth, the goal of covering with high-viscosity GIC was to prevent the enamel break when the teeth reached occlusion and keep an appropriate vertical dimension, while the restoration of the primary teeth was to prevent further pulp pathologies. The literature lacks studies on the use of high viscosity GIC for the restoration of teeth in DGI-II. Equia forte is a high-viscosity GIC composed of highly reactive ultrathin particles resulting in a hybrid restorative material, with improved physical, esthetic and biological properties[25-27]. Also, Equia forte is biocompatible with dental pulp, supporting the use on dentin[25]. Physical-chemical tests showed small deformation of Equia forte restorations under functional stress, which would explain the good behavior in the permanent molars of this case report at 12-month following-up[26].

The enamel presence increases the chances of longer survival of the adhesive restorations, highlighting the importance of the early diagnosis and treatment in these cases for a predictable prognosis[18]. At 12-month follow-up evaluation, the multi-surface restorations of primary teeth with more exposed dentin were lost, failures that tend to accomplish in multi-surface cavities[28]. Continuous monitoring is necessary to control the survival of the restorations. When failures in the restorative procedure are precociously diagnosed, it is possible to intervene in advance for problems such as dental caries or aesthetic and/or functional issues (such as chewing or speaking). Therefore, every clinical case must always be followed up.

Another factor that can be discussed is the lowest difficulty level and cost of this technique compared to dental crowns[29,30], that can be expensive and, as the early rehabilitation is important to avoid the fractures, we have to consider the child's behavior and fear[31]. Using this technique, the child spends less time in the dental chair, with

less discomfort, no tooth wear, avoiding the loss of even more dental structure with non-conservative techniques and being able to rebuild several teeth at once, very important characteristics in patients with GID, who have several compromised teeth. The early diagnosis and treatment of teeth with DGI-II play an essential role in dental preservation and child's psychological and functional aspects. This case report shows the impact on the boy's quality of life, changing his shy behavior to a more communicative one and giving him safety for smiling and eating normally again.

In conclusion, the rehabilitation with high-viscosity glass ionomer cement of teeth with DGI-II using the replica technique improved the esthetics, function, and psychological behavior of the child with a satisfactory durability.

The rehabilitation with replica technique and high-viscosity glass ionomer cement can save chair time, because DGI-II is a condition that needs continuous return to the dentist regarding challenging adherence of any adhesive restoration materials.

Data availability

Datasets related to this article will be available upon request to the corresponding author.

Conflicts of interest statement

None.

Author Contribution

Paula Karine Jorge: Design case reports. Conduction case reports. Formulation or evolution of overarching research goals. **Luciana Lourenço Ribeiro Vitor:** Design case reports. Conduction case reports. Formulation or evolution of overarching research goals. **Mariel Tavares Oliveira Prado Bergamo:** Design case reports. Conduction case reports. Formulation or evolution of overarching research goals. **Eloá Cristina Passucci Ambrosio:** Conducting investigation process and data/evidence collection. **Simone Soares:** Creation and/or presentation of the published work, specifically writing the initial draft. Revised and approved the final version of the manuscript. **Thais Marchini de Oliveira:** Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team. **Maria Fidela de Lima Navarro:** Writing - Original Draft Preparation. Project administration. Revised and approved the final version of the manuscript. Supervision of manuscript. **Daniela Rios:** Conceptualization Ideas; formulation and evolution of overarching research goals and aims. Management and coordination responsibility for the research activity planning and execution. All authors actively revised and approved the final version of the manuscript.

References

1. Abukabbos H, Al-Sineedi F. Clinical manifestations and dental management of dentinogenesis imperfecta associated with osteogenesis imperfecta: Case report. Saudi Dent J. 2013 Oct;25(4):159-65. doi: 10.1016/j.sdentj.2013.10.004.

2. American Academy of Pediatric Dentistry. Dental management of heritable dental developmental anomalies. Pediatr Dent. 2017 Sep;39(6):348-53.

3. Gama FJR, Corrêa IS, Valerio CS, Ferreira EF, Manzi FR. Dentinogenesis imperfecta type II: A case report with 17 years of follow-up. Imaging Sci Dent. 2017 Jun;47(2):129-33. doi: 10.5624/isd.2017.47.2.129.

4. Kamboj M, Chandra A. Dentinogenesis imperfecta type II: an affected family saga. J Oral Sci. 2007 Sep;49(3):241-4. doi: 10.2334/josnusd.49.241.

5. Shields ED, Bixler D, el-Kafrawy AM. A proposed classification for heritable human dentine defects with a description of a new entity. Arch Oral Biol. 1973 Apr;18(4):543-53. doi: 10.1016/0003-9969(73)90075-7.

6. Online Mendelian Inheritance in Man: OMIM. McKusick-Nathans Institute of Genetic Medicine, Johns Hopkins University (Baltimore, MD) [cited 2019 Mar. 12]. Avaliable from: https://omim.org/.

7. De Coster PJ. Dentin disorders: anomalies of dentin formation and structure. Endod Topics. 2009;21(1):41-61. doi: 10.1111/j.1601-1546.2012.00272.x

8. Takagi Y, Sasaki S. A probable common disturbance in the early stage of odontoblast differentiation in dentinogenesis imperfecta type I and type II. J Oral Pathol. 1988 May;17(5):208-12. doi: 10.1111/j.1600-0714.1988.tb01526.x.

9. Zhang X, Zhao J, Li C, Gao S, Qiu C, Liu P, et al. DSPP mutation in dentinogenesis imperfecta Shields type II. Nat Genet. 2001 Feb;27(2):151-2. doi: 10.1038/84765.

10. Hart TC, Hart PS. Genetic studies of craniofacial anomalies: clinical implications and applications. Orthod Craniofac Res. 2009 Aug;12(3):212-20. doi: 10.1111/j.1601-6343.2009.01455.x.

11. de La Dure-Molla M, Philippe Fournier B, Berdal A. Isolated dentinogenesis imperfecta and dentin dysplasia: revision of the classification. Eur J Hum Genet. 2015 Apr;23(4):445-51. doi: 10.1038/ejhg.2014.159. Epub 2014 Aug 13.

12. Wieczorek A, Loster J, Ryniewicz W, Ryniewicz AM. Dentinogenesis imperfecta - hardness and Young's modulus of teeth. Acta Bioeng Biomech. 2013;15(3):65-9.

13. Witkop CJ Jr. Hereditary defects of dentin. Dent Clin North Am. 1975 Jan;19(1):25-45

14. Holappa H, Nieminen P, Tolva L, Lukinmaa PL, Alaluusua S. Splicing site mutations in dentin sialophosphoprotein causing dentinogenesis imperfecta type II. Eur J Oral Sci. 2006 Oct;114(5):381-4. doi: 10.1111/j.1600-0722.2006.00391.x.

15. Leal CT, Martins LD, Verli FD, Souza MA, Ramos-Jorge ML. Case report: Clinical, histological and ultrastructural characterization of type II dentinogenesis imperfecta. Eur Arch Paediatr Dent. 2010 Dec;11(6):306-9. doi: 10.1007/BF03262769.

16. Barron MJ, McDonnell ST, Mackie I, Dixon MJ. Hereditary dentine disorders: dentinogenesis imperfecta and dentine dysplasia. Orphanet J Rare Dis. 2008 Nov 20;3:31. doi: 10.1186/1750-1172-3-31.

17. Garg SK, Bansal S, Mittal S, Bhathal MK. Dentinogenesis imperfecta-aetiology and prosthodontic management. Indian J Dent Sci. 2012 Mar;4(1):75-8.

18. Beltrame AP, Rosa MM, Noschang RA, Almeida IC. Early rehabilitation of incisors with dentinogenesis imperfecta type II - case report. J Clin Pediatr Dent. 2017;41(2):112-5. doi: 10.17796/1053-4628-41.2.112.

19. Devaraju D, Devi BY, Vasudevan V, Manjunath V. Dentinogenesis imperfecta type I: a case report with literature review on nomenclature system. J Oral Maxillofac Pathol. 2014 Sep;18(Suppl 1):S131-4. doi: 10.4103/0973-029X.141363.

20. Mendonça FL, Di Leone CCL, Grizzo IC, Cruvinel T, Oliveira TM, Navarro MFL, et al. Simplified occlusal replica adapted technique with glass ionomer cement for molar-incisor hypomineralization-affected molars: an 18-month follow-up. J Am Dent Assoc. 2020 Sep;151(9):678-83. doi: 10.1016/j.adaj.2020.06.017.

21. Equia Forte™ comprehensive guide. GC Europe [cited 2019 Mar. 12] Avaliable from: https://www.gc.dental/europe/sites/europe.gc.dental/files/products/downloads/equiaforteht/manual/MAN_Comprehensive_Guide_EQUIA_Forte_HT.pdf.

22. Singh M, Singh S. Hereditary opalescent dentin--a case report. J Indian Soc Pedod Prev Dent. 2004 Sep;22(3):144-7.

23. Pettiette MT, Wright JT, Trope M. Dentinogenesis imperfecta: endodontic implications. Case report. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998 Dec;86(6):733-7. doi: 10.1016/s1079-2104(98)90213-x.

24. Akhlaghi N, Eshghi AR, Mohamadpour M. Dental management of a child with dentinogenesis imperfecta: a case report. J Dent (Tehran). 2016 Mar;13(2):133-8.

25. Collado-González M, Pecci-Lloret MR, Tomás-Catalá CJ, García-Bernal D, Oñate-Sánchez RE, Llena C, et al. Thermo-setting glass ionomer cements promote variable biological responses of human dental pulp stem cells. Dent Mater. 2018 Jun;34(6):932-43. doi: 10.1016/j.dental.2018.03.015.

26. Ong J, Yap AU, Hong JY, Eweis AH, Yahya NA. Viscoelastic properties of contemporary bulk-fill restoratives: a dynamic-mechanical analysis. Oper Dent. 2018 May/Jun;43(3):307-14. doi: 10.2341/16-365-L.

27. Fuhrmann D, Murchison D, Whipple S, Vandewalle K. Properties of new glass-ionomer restorative systems marketed for stress-bearing areas. Oper Dent. 2020 Jan/Feb;45(1):104-10. doi: 10.2341/18-176-L. Epub 2019 Sep 30.

28. Grossi JA, Cabral RN, Ribeiro APD, Leal SC. Glass hybrid restorations as an alternative for restoring hypomineralized molars in the ART model. BMC Oral Health. 2018 Apr;18(1):65. doi: 10.1186/s12903-018-0528-0.

29. Sarapultseva M, Leleko A, Sarapultsev A. Case report: Rehabilitation of a child with dentinogenesis imperfecta with CAD/CAM approach: Three-year follow-up. Spec Care Dentist. 2020 Sep;40(5):511-8. doi: 10.1111/scd.12500.

30. Shi S, Li N, Jin X, Huang S, Ma J. A digital esthetic rehabilitation of a patient with dentinogenesis imperfecta type II: a clinical report. J Prosthodont. 2020 Oct;29(8):643-50. doi: 10.1111/jopr.13237.

31. Kaur R, Karadwal A, Sharma D, Sandhu MK. Dentinogenesis imperfecta type II: Diagnosis, functional and esthetic rehabilitation in mixed dentition. J Oral Maxillofac Pathol. 2021 Mar;25(Suppl 1):S76-S80. doi: 10.4103/jomfp.JOMFP_172_20.