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Clinical Technique/Case Report

Ceramic Veneers and Direct-Composite Cases of Amelogenesis Imperfecta Rehabilitation

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Clinical Relevance

Amelogenesis imperfecta is a hereditary disease affecting the quality and quantity of enamel. Patients usually suffer from oral complications and poor dental esthetics, which directly affect their quality of life. Function and esthetics can be restored with different restorative materials, such as ceramic and composite resin. Dentists need to be aware of the best material to use for each patient.

SUMMARY

The aim of this article is to present two case reports for the treatment of patients affected with amelogenesis imperfecta. One case was treated with composite resin and the other case with ceramic veneers. Esthetic and functional results were achieved using both treatments, and a review of advantages and disadvantages is presented.

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DOI: 10.2341/15-079-T

INTRODUCTION

Amelogenesis imperfecta (AI) is a term for a clinically and genetically heterogeneous group of conditions that are caused by mutations in a variety of genes that are critical for normal enamel formation. The gene mutations alter the quality and/or quantity of enamel in the primary and permanent dentitions. Initial classifications of AI had been based exclusively on the phenotype (appearance). More recent classifications include both the phenotype and the mode of inheritance. The outdated AI classification system recognized four phenotypes: 1) hypoplastic, 2) hypomaturation, 3) hypocalcified, and 4) hypoplastic-hypomaturation. However, today, at least 14 AI subtypes are identified when both phenotype and mode of inheritance are considered.[1-3]

AI prevalence has been reported to vary from 1/700 to 1/14,000, depending on the population

Figure 1. *Initial view of Case 1.*
Figure 2. *Initial view of Case 2.*

studied. AI affects all tooth enamel of the affected individuals, without reference to chronology and occasionally in association with other generalized conditions. Based on the literature, regardless of AI subtype, patients have similar oral complications and poor dental esthetics. For all patients, the affected teeth may be discolored, sensitive, or prone to either preeruption or posteruption disintegration.[3,4]

This developmental dental anomaly appears to have a profound impact on patients' quality of life. Hashem and others[5] studied the impact of hypodontia and AI on the quality of life and self-esteem of adult patients. For AI patients, the condition significantly affected psychological discomfort related to physical, psychological, and social disabilities. Although different treatment modalities have been described for the rehabilitation of AI in adults and children, treatment is always a great challenge to clinicians.

The aim of this article is to describe minimally invasive techniques for the prosthetic rehabilitation of two young adult female patients with AI. This was based on conservative and adhesive treatments through the use of laminate veneers and direct composite resins.

CLINICAL CASE REPORT

In both cases reported, female patients, 17 and 19 years old, were diagnosed with the hypoplastic type of AI (Figures 1 and 2). Both family histories revealed that the patients' sisters also had similar dental deformities. Clinical examination revealed porous enamel, with generalized mottled and chipped appearance, and generalized discoloration of all teeth (posterior and anterior). The enamel layer could be distinguished from the underlying dentin; however, it was generally thin. Radiographic examination with panoramic and periapical x-rays did not reveal any missing teeth or periapical lesions. Both patients were dissatisfied with their dental appearance.

Treatment goals were to prevent further tooth destruction, improve esthetics, and restore oral

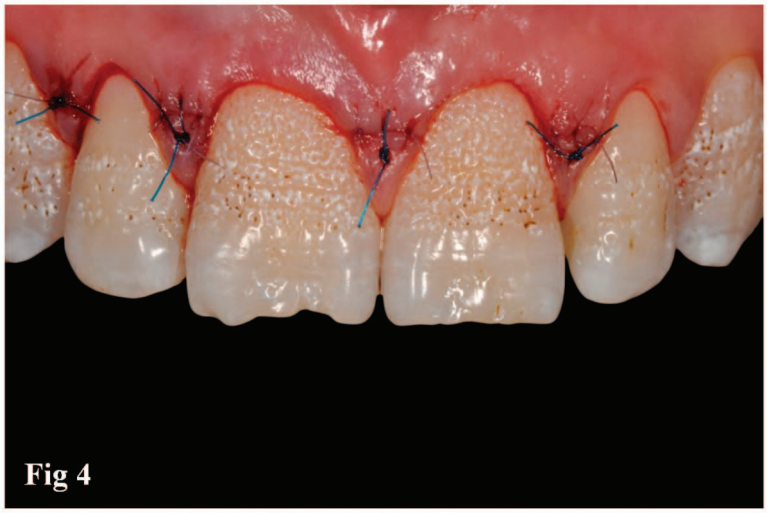

Figure 3. *Case 1: Composite resin mock-up.*
Figure 4. *Case 1: Gingivectomy in anterior region.*
Figure 5. *Case 1: Teeth after all preparation.*

function. Initial impressions were obtained and study casts were constructed with hard stone. A full wax-up was performed on the study casts, and a direct mock-up was carried out in the patient's mouth with an auto-mixing, self-curing bis-acrylic resin (Protemp Plus). After checking the occlusion, both patients approved the treatment plans, which are as follows for each case.

Figure 6. *Case 1: Ceramic laminate veneers.*
Figure 7. *Case 1: Final clinical result.*

Case 1: 17-Year-Old Female

- Periodontal treatment (gingivectomy)
- Preparation of maxillary anterior teeth (Nos. 4-13) for ceramic laminate veneers
- Fabrication of laminate veneers
- Adhesive cementation

Initially, periodontal surgery was carried out using a composite resin mock-up as a guide (Figure 3). A gingivectomy was sufficient to achieve correction of gingival levels and proper width-to-length tooth ratios (Figure 4). Three months after the surgery, the maxillary teeth were prepared with a diamond bur No. 2135, under water spray. All preparation had less than a 0.5-mm depth, and the margins were placed on sound enamel (Figure 5). Final impressions and occlusal registrations were obtained with polyvinyl siloxane elastomer material, and provisional restorations were made from composite resin (Empress Direct) without previous enamel etching (Table 1).

All-ceramic laminate veneers were fabricated with a lithium disilicate–reinforced ceramic (IPS e-max Press; Figure 6). The internal surfaces of the ceramic restorations were etched with 5% hydrofluoric acid for 20 seconds, rinsed with water, and dried with an air spray. One layer of silane (Monobond-S) was applied for 60 seconds on the etched surface and dried for 60 seconds. The enamel surfaces were etched with 37% phosphoric acid for 20 seconds. After being rinsed and dried, two layers of an adhesive (Ambar) and mild air jets were applied until a shiny appearance was observed on the uncured surface. A small amount of photo-cured resin cement (Variolink Veneer) was applied over the restoration's internal surface and positioned. After the excess was removed, the resin was light-cured for 60 seconds using an LED unit (900 mW/cm^2 output). Finishing and polishing of the margins were carried out, and the occlusion was checked (Figure 7).

The patient was satisfied and examined two weeks later. All restorations were intact, oral hygiene was

Table 1: *Materials Used*

	Case 1
Protemp Plus (bis-acryl temporally resin)	3M ESPE (St Paul, MN, USA)
KG #2135 (diamond bur)	KG Sorensen (Cotia, Brazil)
Express XT (polyvinyl siloxane)	3M ESPE (St Paul, MN, USA)
Empress Direct (composite resin)	Ivoclar Vivadent (São Paulo, Brazil)
IPS e-max Press (Lithium disilicate-reinforced ceramic)	Ivoclar Vivadent (São Paulo, Brazil)
5% Hydrofluoric acid (porcelain etching gel)	FGM (Joinville, Brazil)
Phosphoric acid 37% (etching gel)	BM4 (Florianópolis, SC, Brazil)
Monobond-S (silane agent)	Ivoclar Vivadent (São Paulo, Brazil)
Ambar (adhesive)	FGM (Joinville, Brazil)
Variolink Veneer (resin cement)	Ivoclar Vivadent (São Paulo, Brazil
Bluephase (LED unit)	Ivoclar Vivadent (São Paulo, Brazil)
Case 2	
Protemp Plus (bis-acryl tempory resin)	3M ESPE (St Paul, MN, USA)
Phosphoric acid 37% (etching gel)	BM4 (Florianópolis, SC, Brazil)
Single Bond2 (adhesive)	3M ESPE (St. Paul, MN, USA)
Empress Direct (composite resin)	Ivoclar Vivadent (São Paulo, Brazil)
Elite Glass (polyvinyl siloxane)	Zhermack (Badia Polesine, Italy)
Bluephase (LED unit)	Ivoclar Vivadent (São Paulo, Brazil)
Polyester Strip Matrix	TDV (Santa Catarina, Brazil)
KG#9642FF (diamond bur)	KG Sorensen (Cotia, Brazil)
Soflex (polishing discs)	3M ESPE (St. Paul, MN, USA)
Astrobrush (impregnated brush)	Ivoclar Vivadent (São Paulo, Brazil)

maintained, and gingiva appeared healthy with no inflammation or recession.

Case 2: 19-Year-Old Female

- Removal of old restorations
- Direct restoration with composite resin

Initially, old restorations were removed with diamond burs and a scalpel blade. The restorations were carefully removed to preserve sound enamel and avoid any type of preparation. Afterward, the hypoplastic enamel was sandblasted with aluminum oxide particles to remove composite remains and debris from the surface (Figure 8).

The anterior incisors were restored, one by one, respecting the following protocol: enamel surface etched with phosphoric acid for 30 seconds, rinsed with air/water spray for the same period, dried for 60 seconds, two layers of adhesive (Single Bond2) applied and light-cured for 15 seconds.

All restorations were performed using an auxiliary lingual index to determine the incisal edge. An initial layer of shade BL-L enamel composite resin was used and light-cured for 60 seconds (Figure 9). To enhance restoration value, a composite layer shade A2 was inserted and light-cured for 60 seconds (Figure 10). A transparent index made from polyvinyl siloxane (Elite Glass) had been fabricated to record the facial surface of the wax-up (Figures 11 and 12). Then, a final composite layer of enamel resin, shade BL-L, was inserted with the aid of the index (Figures 13 and 14). Light-curing was performed through the index for 60 seconds and final polymerization for a further 60 seconds without the index (Figures 15 and 16). While in the proximal areas, the restorations were performed by a pull-through technique. One increment of enamel resin, shade BL-L, was pulled from the facial toward the lingual surface with a celluloid strip (TDV). The excess of material was removed with scalpel blade No. 12 and diamond burs FF.

After 24 hours, finishing and polishing of the restorations were performed with diamond burs No. 9642FF (KG Sorensen), abrasive discs of different grades (Sof-lex), and a brush impregnated with silicon carbide (Astrobrush; Figure 17).

DISCUSSION

AI affects the quality and/or quantity of enamel in the primary and permanent dentitions. Both cases showed affected enamel, which was easily distinguished from dentin. Although in the first case the enamel surface had not been equally affected by a mottled appearance, a thin layer and incisal edge fracture were observed. The enamel severity depends on the gene mutation, which defines different AI phenotypes.[1,3]

Restoring esthetics and function of a young patient with AI is a challenge for the clinician. The treatment options vary considerably, depending mainly on the patient's age, AI type, disorder severity, and intraoral situation.[6,7] Treatment options advocated in the literature include composite resins, stainless steel crowns, all-ceramic

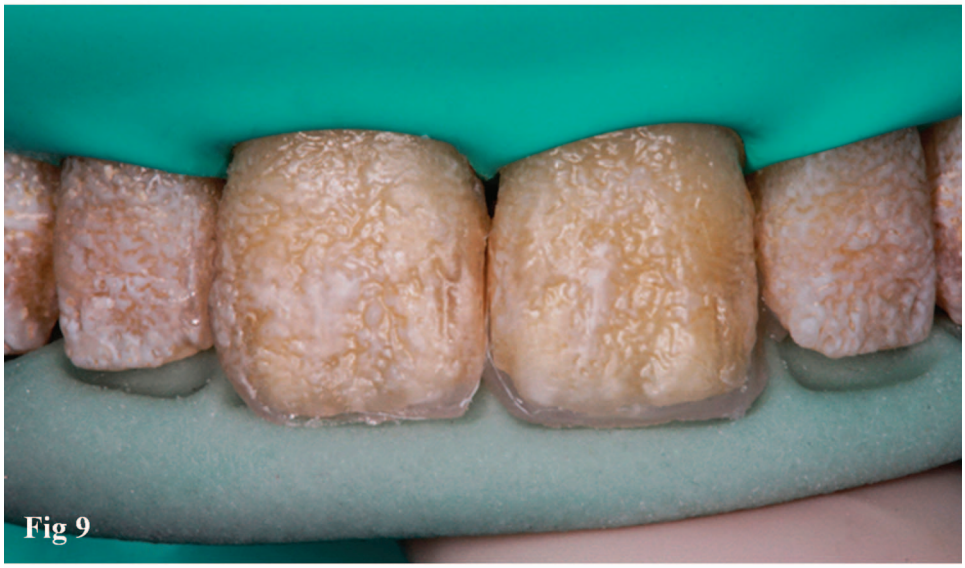

Figure 8. *Case 2: Sandblasting with aluminum oxide particles.*
Figure 9. *Case 2: Composite resin palatal enamel layer.*
Figure 10. *Case 2: Composite resin dentin layer.*

Figure 11. *Case 2: Additive diagnostic wax-up.*
Figure 12. *Case 2: Transparent index fabricated.*

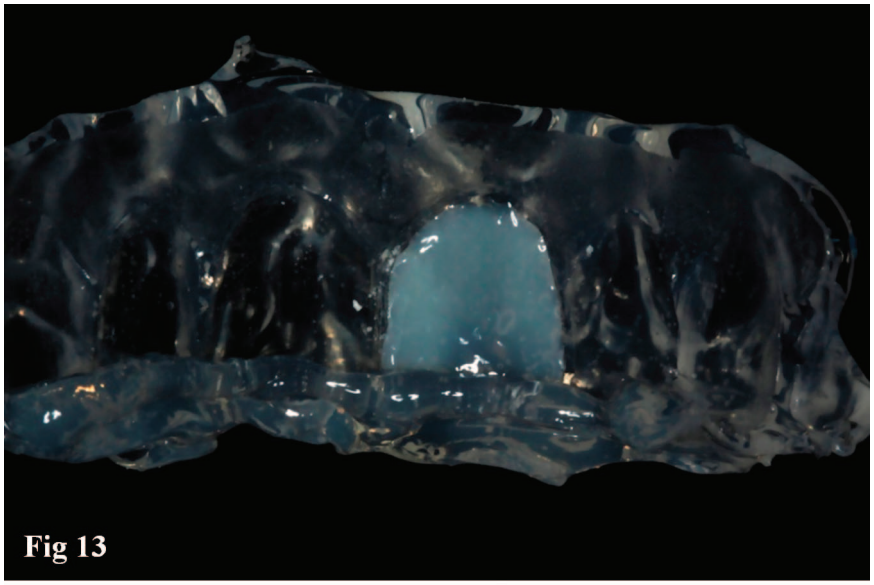

Figure 13. *Case 2: Enamel composite inserted in the internal surface of the index.*
Figure 14. *Case 2: Index in position.*

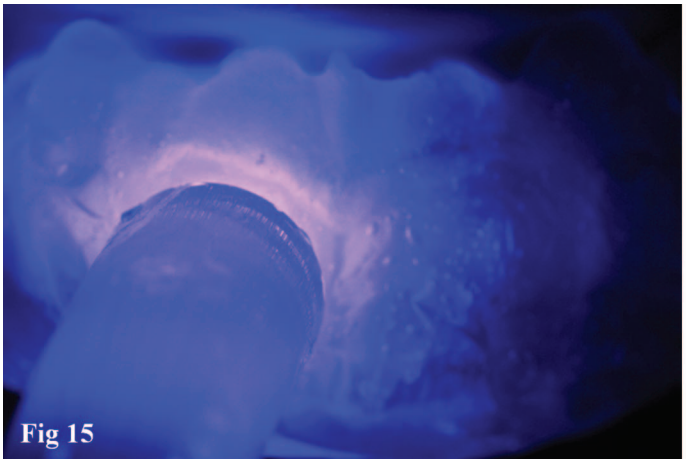

Figure 15. *Case 2: Composite resin enamel photoactivation through the silicone index.*
Figure 16. *Case 2: Vestibular composite resin enamel layer.*

crowns, and currently, the more frequently used laminate veneers.[2,3] In this clinical report, two young patients were diagnosed with hypoplastic type AI but were rehabilitated with different restorative materials since the esthetic demand was not the same.

Conventional crowns are the most common treatment recommended for patients with AI.[8,9] Most patients, consequently, have a large amount of healthy tooth structure removed. Optimal preparation design for ceramic crowns is a paradox, since patients already suffer from tooth-tissue loss and pulpal injury, especially young patients.[10] The decision to remove all enamel or keep an enamel layer depends on the depth and extent of the lesions. The clinical appearance of the enamel during tooth preparation plays a decisive role.[7] Several studies have illustrated the use of all-ceramic crowns,[4,10,11] but other authors have described less invasive treatments, including composite resin and laminate veneers.[9,12,13]

Composite resin is able to mimic tooth color through anatomical stratification and proper placement of tints and opaquers, to enhance the esthetic value. The long-term success of direct composites may depend on patient selection, cavity location and size, material choice, and operative technique. Risks for failure include fracture and partial loss

Figure 17. *Case 2: Final clinical result.*

of restorative material.[14] A randomized, split-mouth clinical study reported by Gresnigt and others[15] evaluated the survival rate of direct laminate veneers made of two resin-composite materials. Clinical performance of the two micro-hybrid composite laminate veneers showed a similar survival rate (87.5%). Besides absolute failures, surface roughness and marginal discoloration were the main qualitative deteriorations observed until the final recall.

In case 2, composite resin was used in the anterior and posterior teeth so that orthodontic treatment could be carried out in the future. An advantage to using composite resin was that the sound enamel was preserved and no type of preparation was needed. However, a concern regarding this treatment is related to the adhesive resistance of the hypoplastic enamel. Yaman and others,[16] in an *in vitro* study, observed that self-etching and etch-and-rinse adhesive systems provide reliable bonding to the enamel affected by hypoplastic AI. Another positive aspect is the use of a transparent index to restore the facial surface of the anterior teeth. The index made from polyvinyl siloxane has an excellent reproduction capability, being able to restore contour, shape, and anatomy according to the diagnostic wax-up.

Ceramic has some advantages when compared with composite resin restorations: it is more esthetic, has greater durability and biocompatibility, and has less plaque accumulation.[17,18] However, the vast majority of teeth receiving porcelain laminate veneers should have some enamel removal, usually approximately 0.5 mm. If dentin is exposed, protection is recommended for the period between preparation and cementation in order to prevent postoperative sensitivity and bacterial invasion.[19]

In case 1, ceramic laminate veneers were selected for rehabilitation of all upper teeth. The decision to use ceramic restorations was based on mock-up and patient concern about esthetics and treatment longevity. Several studies[20-23] demonstrated that ceramic laminate veneers have a low clinical failure rate. According to Gresnigt and others,[24] there was no statistically significant difference in survival rates for up to 36 months compared with composite laminate veneers. However, surface quality changes were more frequently observed in composite veneers. In addition, good oral hygiene and absence of parafunctional habits led to the choice of ceramic veneers. A clinical study by Granell-Ruíz and others[25] found that the presence of fractures and debonding of ceramic laminate veneers increased considerably in patients with bruxism. The mock-up indicated no need to extend the preparation depth because the space necessary for the laminate already existed. Based on this, the enamel surface was just regularized to provide a uniform adaptation of the ceramic restoration.

The selection criteria for the two different materials used in rehabilitation of AI patients can be summarized by the following: 1) disorder type and severity, 2) patient age, 3) esthetic demand, 4) treatment longevity, 5) presence or absence of parafunctional habits, 6) oral hygiene, and 7) financial cost. Proper diagnosis and good treatment planning are fundamental to obtaining a satisfactory result for rehabilitation of patients with AI.

CONCLUSION

In both cases presented, the AI disorder type was not very severe. Therefore, less invasive techniques could be performed; case 1 and case 2 could be rehabilitated with ceramic veneers and direct composite resin restorations, respectively. Both treatments have advantages and disadvantages and can be used to successfully restore esthetics and function in patients with AI.

Regulatory Statement

This work was conducted in accordance with all the provisions, guidelines, and policies of the Universidade Federal de Santa Catarina, Florianópolis, Brazil.

Conflict of Interest

The authors have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

(Accepted 8 July 2015)

REFERENCES

1. Wright JT (2006) The molecular etiologies and associated phenotypes of amelogenesis imperfecta *American Journal of Medical Genetics. Part A* **140(23)** 2547-2555.
2. Ng FK, & Messer LB (2009) Dental management of amelogenesis imperfecta patients: a primer on genotype-phenotype correlations *Pediatric Dentistry* **31(1)** 20-30.
3. Crawford PJ, Aldred M, & Bloch-Zupan A (2007) Amelogenesis imperfecta *Orphanet Journal of Rare Diseases* **2(17)** 1-11.
4. Vivek R, Singh A, Singh RK, Soni R, & Chaturvedi TP (2013) Amelogenesis imperfecta: functional and esthetic rehabilitation of a mutilated dentition *Indian Journal of Dentistry* **4(1)** 60-65.
5. Hashem A, Kelly A, O'Connell B, & O'Sullivan M (2013) Impact of moderate and severe hypodontia and amelogenesis imperfecta on quality of life and self-esteem of adult patients *Journal of Dentistry* **41(8)** 689-694.

6. Sengun A, & Ozer F (2002) Restoring function and esthetics in a patient with amelogenesis imperfecta: a case report *Quintessence International* **33(3)** 199-204.

7. Kostoulas I, Kourtis S, Andritsakis D, & Doukoudakis A (2005) Functional and esthetic rehabilitation in amelogenesis imperfecta with all-ceramic restorations: a case report *Quintessence International* **36(5)** 329-38.

8. Gemalmaz D, Isik F, Keles A, & Küker D (2003) Use of adhesively inserted full-ceramic restorations in the conservative treatment of amelogenesis imperfecta: a case report *Journal of Adhesive Dentistry* **5(3)** 235-242.

9. Oliveira IK, Fonseca Jde F, do Amaral FL, Pecorari VG, Basting RT, & França FM (2011) Diagnosis and esthetic functional rehabilitation of a patient with amelogenesis imperfecta *Quintessence International* **42(6)** 463-469.

10. Preissner S, Kostka E, & Blunck U (2013) A noninvasive treatment of amelogenesis imperfecta *Quintessence International* **44(4)** 303-305.

11. Chan KH, Ho EH, Botelho MG, & Pow EH (2011) Rehabilitation of amelogenesis imperfecta using a reorganized approach: a case report *Quintessence International* **42(5)** 385-391.

12. Ardu S, Duc O, Krejci I, & Perroud R (2013) Amelogenesis imperfecta: a conservative and progressive adhesive treatment concept *Operative Dentistry* **38(3)** 235-241.

13. Tunkiwala A, & Vazifdar D (2014) Conservative esthetic rehabilitation of a young patient with amelogenesis imperfecta *Compendium of Continuing Education in Dentistry* **35(3)** 175-182.

14. Sadowsky SJ (2006) An overview of treatment considerations for esthetic restorations: a review of the literature *Journal of Prosthetic Dentistry* **96(6)** 433-442.

15. Gresnigt MM, Kalk W, & Ozcan M (2012) Randomized controlled split-mouth clinical trial of direct laminate veneers with two micro-hybrid resin composites *Journal of Dentistry* **40(9)** 766-775.

16. Yaman BC, Ozer F, Cabukusta CS, Eren MM, Koray F, & Blatz MB (2014) Microtensile bond strength to enamel affected by hypoplastic amelogenesis imperfecta *Journal of Adhesive Dentistry* **16(1)** 7-14.

17. Della Bona A, & Kelly JR (2008) The clinical success of all ceramic restorations *Journal of the American Dental Association* **139(Supplement)** 8-13.

18. Silva NR, Thompson VP, Valverde GB, Coelho PG, Powers JM, Farah JW, & Esquivel-Upshaw J (2011) Comparative reliability analyses of zirconium oxide and lithium disilicate restorations in vitro and in vivo *Journal of the American Dental Association* **142 (Supplement 2)** 4S-9S.

19. Peumans M, Van Meerbeek B, Lambrechts P, & Vanherle G (2000) Porcelain veneers: a review of the literature *Journal of Dentistry* **28(3)** 163-177.

20. Fradeani M, Redemagni M, & Corrado M (2005) Porcelain laminate veneers: 6- to 12-year clinical evaluation-a retrospective study *International Journal of Periodontics and Restorative Dentistry* **25(1)** 9-17.

21. Burke FJ (2012) Survival rates for porcelain laminate veneers with special reference to the effect of preparation in dentin: a literature review *Journal of Esthetic and Restorative Dentistry* **24(4)** 257-265.

22. D'Arcangelo C, De Angelis F, Vadini M, & D'Amario M (2012) Clinical evaluation on porcelain laminate veneers bonded with light-cured composite: results up to 7 years *Clinical Oral Investigations* **16(4)** 1071-1079.

23. Layton DM, & Clarke M (2013) A systematic review and meta-analysis of the survival of non-feldspathic porcelain veneers over 5 and 10 years *International Journal of Prosthodontics* **26(2)** 111-124.

24. Gresnigt MM, Kalk W, & Ozcan M (2013) Randomized clinical trial of indirect resin composite and ceramic veneers: up to 3 follow-up *Journal of Adhesive Dentistry* **15(2)** 181-190.

25. Granell-Ruíz M, Agustín-Panadero R, Fons-Font A, Román-Rodríguez JL, & Solá-Ruíz MF (2014) Influence of bruxism on survival of porcelain laminate veneers *Medicina Oral, Patología Oral y Cirugía Bucal* **19(5)** 426-432.