10.5005/jp-journals-10024-2442

CASE REPORT

Prefabricated Laser Sintered Composite Veneers and Occlusal Vertical Dimensions: Case Reports

[1]Ipsha Singh, [2]Rohit Shetty, [3]Deepak Mehta, [4]Stephan Iampl, [5]Naufil Chida

ABSTRACT

Aim: To highlight the concept of prefabricated veneers and occlusal vertical dimension (OVD) and series of case report using edelweiss prefabricated veneer system.

Background: Edelweiss prefabricated veneer system presents a concept of biofunctional esthetics using laser sintered composite resins. The system`s biofunctionality and versatile area of application combined with its time and cost saving procedure make the edelweiss veneer and occlusion system a sound investment for the future.

Case description: A series of case reports treated using prefabricated laser sintered composite veneer system has been presented.

Conclusion: Prefabricated veneer is a milestone in operative dentistry, as it contributes tremendously to direct composite application, helping a larger number of our patients to receive esthetic restorations that are more conservative and affordable.

Clinical significance: The prefabricated composite veneering technique provides a minimally invasive, chair-side technique for esthetic and full mouth rehabilitation.

Keywords: Aesthetics, Full mouth rehabilitation, Laser sintered, Nanohybrid composite, Prefabricated veneer.

How to cite this article: Singh I, Shetty R, Mehta D, Iampl S, Chida N. Prefabricated Laser Sintered Composite Veneers and Occlusal Vertical Dimensions: Case Reports. J Contemp Dent Pract 2018;19(11):1418-1424.

Source of support: Nil

Conflict of interest: None

[1-2,5]Department of Prosthodontics, KLE Society's Institute of Dental Sciences, Bengaluru, Karnataka, India

[3]Department of Conservative and Endodontics, Dental Bloom, Bengaluru, Karnataka, India

[4]Edelweiss Dentistry, Austria

Corresponding Author: Ipsha Singh, Department of Prosthodontics, KLE Society's Institute of Dental Sciences, Bengaluru, Karnataka, India, Mobile: +919902823778, e-mail: ipsha.S@gmail.com

INTRODUCTION

Esthetic demands in dentistry have grown exponentially in the last few decades and is driven by the quest of our patients to look attractive and alluring. The aesthetic dentists are now the neoteric partners in the briskly changing technology industry. In the present scenario, we have a variety of materials and procedure options for an aesthetically pleasing restoration and the "laser sintered composite veneer" is one of them.[1] In 1928 veneers in the form of thin ceramic facing was first introduced by Dr Pincus which was temporarily fixed to the tooth using denture adhesives. In the 1930s after the invention of adhesive dentistry, ceramic veneers could be successfully bonded to the tooth, and since then it has been a benchmark for aesthetic restorations. About 35 years ago prefabricated composite veneers were introduced but with somewhat limited success due to former technological limitations and hence this riveting treatment option was replaced with the increase in ceramic veneering technique.[2] Recently this concept has been reinvented with the help of newer technology *via.* surface laser vitrification. Edelweiss dentistry presents a newer concept of direct esthetic restoration and full mouth rehabilitation using prefabricated veneers and occlusion VDs. This provides a single appointment and chairside technique which is minimally invasive, simple, versatile, affordable and with highly natural looking aesthetic clinical results. The occlusion VDs have been a breakthrough in the conservative and minimally invasive dentistry and provides a one-stop solution for restoring root canal treated tooth, attrition, and loss of vertical dimension.[1] This series of clinical case report presents a step-by-step procedure in the application of edelweiss prefabricated composite veneers and occlusion VDs.

CASE REPORTS

Case 1

KLE Society's Institute of Dental Sciences, Bengaluru, India, the chief complaint of the patient was deformed upper front teeth and correction for the same.

On intraoral examination, peg-shaped laterals were noted with respect to 12, 22 (Figs 1A and B). The peg shaped laterals had open contact with respect to the adjacent teeth and therefore the ceramic full coverage crowns after endodontic treatment would be the routine treatment option. But as this treatment option was too invasive for a young patient, a minimally invasive technique of prefabricated composite veneers was chosen as the treatment modality to restore the peg-shaped laterals to normal shape and size.

Procedure

Maxillary and mandibular diagnostic cast was made, and the mockup of the peg-shaped laterals was done to give a normal shape to it. Over the mock up a putty template was fabricated which later used to build up the palatal contacts of the lateral incisors with the adjacent teeth. Using the mockup and the size guide an appropriate size of the veneer (usually slightly larger than tooth if not exactly the same size of the tooth) was selected and then customized .

Retraction cord was placed around the tooth, and the palatal surface of the lateral incisor was roughened using football-shaped diamond, rinsed and then dried (Fig. 1C). Etchant was applied over the roughened tooth surface (Fig. 1D), it was then rinsed and dried after 30 seconds, following which two coats of bonding agent was applied, it was air dried and light cured for 15 seconds Then the template was placed on the palatal surface of the tooth and proximal contact build up was done using Edelweiss nanohybrid composite material. Following which the veneer preparation was done, i.e., the intaglio surface of the veneer was roughened,

Figs 1A to G: (A) Preopertive labial view; (B) Peg shaped lateral; (C) Tooth preparation; (D) Application of Etchant; (E) Application of bonding agent; (F) Veneers bonded on tooth; (G) Postoperative view

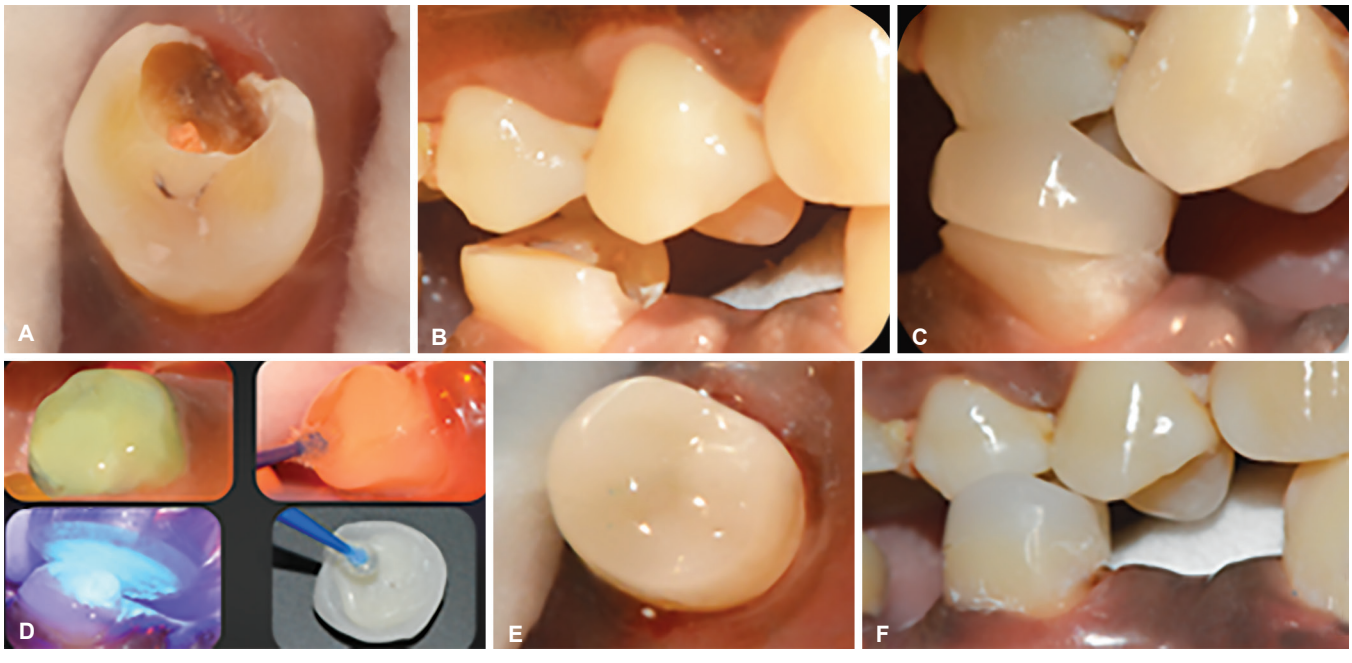
cleaned and then veneer bond was applied to it, air dried and the light cured for 15 seconds (Fig. 1E). Effect shade was applied to the incisal aspect of the veneer to mimic the translucency of the adjacent central incisor and light cured. After that labial surface of the tooth was roughened, it was etched with 32% phosphoric acid, washed and dried and then bonding agent was applied and light cured for 15 seconds. Dentin shade composite similar to the shade of central incisor was loaded on the cervical aspect of the inner surface of the veneer and enamel shade was loaded on the incisal aspect of the veneer. Following this Mylar strip was placed around the lateral incisor separating it from the adjacent teeth, and the veneer was positioned on the tooth using a teflon coated spatula. After that, the retraction cord was removed, and the excess composite was contoured, and tack curing was done all around the veneer for 2 seconds. Then the excess composite was trimmed all over using Benda brush, and final finishing and polishing was done using soflex polishing paste and diamond impregnated cup. Final polymerization was done for 40 seconds for each veneer (Figs 1F and G). The occlusion was checked in centric and eccentric movements.

Case 2

A patient with root canal treated mandibular second premolar was referred to the department of prosthodontics, KLE Society's Institute of Dental Sciences, Bengaluru, India, for prosthetic rehabilitation (Figs 2A and B). On clinical examination, reduced crown height was noticed, and the periodontist recommended resective crown lengthening. To make the treatment of non-surgical and minimally invasive Edelweiss occlusal VD was planned to restore the root canal treated tooth.

Procedure

Composite access filling was done for the root canal treated tooth, and adequate clearance of 1mm was achieved with the opposing tooth. Diagnostic maxillary and mandibular cast were made. Using the cast and the size guide the size of the occlusion VD was selected. Then the axial height of the occlusion VD was reduced to fit the space of occlusal clearance with opposing tooth (Fig. 2C). The inner surface of the occlusion VD was roughened, cleaned and dried, then the veneer bond was applied on the roughened surface, and it was light-cured (Fig. 2D). Following this dental floss was placed in the proximal side of the tooth on both mesial and distal side, and then the composite was placed on the inner surface of the occlusion VD, and it was kept on the root canal treated tooth, and the patient was made to bite on it. The occlusion VD was light cured which created an imprint of the tooth for the easy placement of occlusion VD later. After this tooth was roughened, etched and bond was applied, following which light curing was done. A layer of composite was placed over the cured composite in the inner surface of the occlusion VD, and then it was placed over the tooth, and it was pressed with the finger so that the excess composite flows out and the same was then merged with the margin between the tooth and the OVD interface. The patient was asked



Figs 2A to F: (A) Preopertive occlusial view; (B) Preopertive buccal view; (C) Checking fit of occlusial VD; (D) Application of etchant, bonding agent and composite on veneer; (E) Postoperative; (F) Postoperative

to bite on the occlusion VD, and the occlusion on the opposing side of the arch was checked. Following which the final curing was done for 40 seconds on each side of the veneer (Figs 2E and F). Articulating paper was used to check the occlusal high points in centric and eccentric movements. The interferences were corrected using finishing diamond and also the composite around the margin was finished and polished.

Case 3

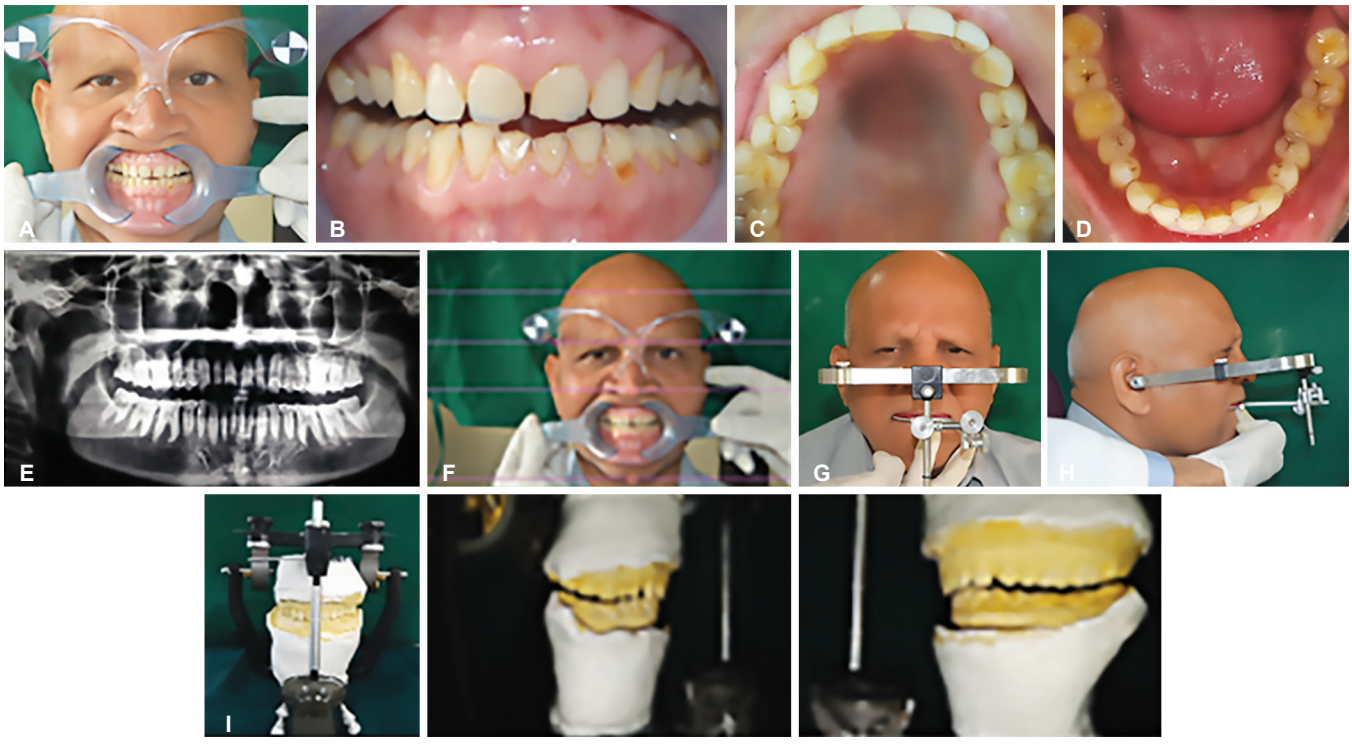
A 52-year-old patient reported to the department of prosthodontics, KLE Society's Institute of Dental Sciences, Bengaluru, India, with the chief complaint of unaesthetic appearance due to wear off in upper and lower front and back teeth (Figs 3A and B).

On intraoral examination, attrition was observed with respect to all the teeth in both the jaws(Figs 3C and D). The patient also presented with anterior deep bite and loss of vertical dimension of occlusion. Full mouth prosthetic rehabilitation was recommended to the patient to restore the aesthetics and function.

Procedure

Diagnostic impression was made for maxillary and mandibular arch using alginate impression material and was poured in type III gypsum product to obtain the diagnostic cast. Detailed case history was recorded for the patient and the vertical dimension at rest and occlusion was re-examined (Figs 3E and F). The loss in vertical dimension at occlusion was evaluated using Niswonger's technique of recording vertical jaw relation, and it was further cross-checked using esthetic and swallowing technique. The amount of loss in the vertical dimension at occlusion was found to be 4 mm. Following this face-bow transfer was done, and the maxillary cast was mounted on the semi-adjustable articulator (Figs 3G and H). Then the centric record was made and the mandibular cast was mounted on the articulator in the centric relation. The size guide was used for correct selection of size for all the anterior and posterior teeth. The vertical dimension at occlusion was increased on the semi-adjustable articulator by raising the vertical pin by 4 mm (Fig 3I). At this increased vertical dimension at occlusion, the mock-up was done for the maxillary and mandibular anterior teeth using self-cure acrylic resins which was then verified for the esthetics and phonetics in the patient's mouth. It was decided to rehabilitate the patient using direct technique and starting with the posterior teeth rehabilitation. Therefore modification in the height of the OVDs was done using composite finishing bur and the diagnostic cast as the guide. The axial height of all the OVDs was reduced to 2 mm so that with the rehabilitation of both the arches a final increase of 4 mm vertical dimension at occlusion could be achieved.

The OVDs were first placed in the maxillary arch in the following manner. For the ease of accessibility



Figs 3A to I: (A) Preopertive; (B, C and D) Preopertive; (E) OPG; (F) Evaluation of vertical dimension; (G) Facebow transfer (Frontal View); (H) Facebow transfer (Sagittal View); (I) Mounting on Semi Adjustable Articulator

2nd molar was first roughened and etched (Fig. 4A). Similarly, all the posterior teeth (1st premolar to 1st molar) in the first quadrant were roughened and then etched using 37% phosphoric acid. After 30 seconds the etchants on the teeth was washed and air dried. Complete isolation of the maxillary arch was done using cotton rolls and high vacuum suction. The bonding agent was applied on the teeth and light cured for a period 15 seconds. Then the veneer preparation was done for which the mesiodistal and buccolingual size of the veneer was verified on the tooth, and the modification was done to achieve the correct size of the veneer (Fig. 4B). The bonding of veneer was started from the molar for ease of accessibility (Fig. 4C). Dental floss was placed in both proximal sides of the tooth. The A2 shade composite resin was placed on the inner surface of the veneer and correctly oriented onto the tooth following which the veneer was light cured using LED light for a period of 40 seconds.

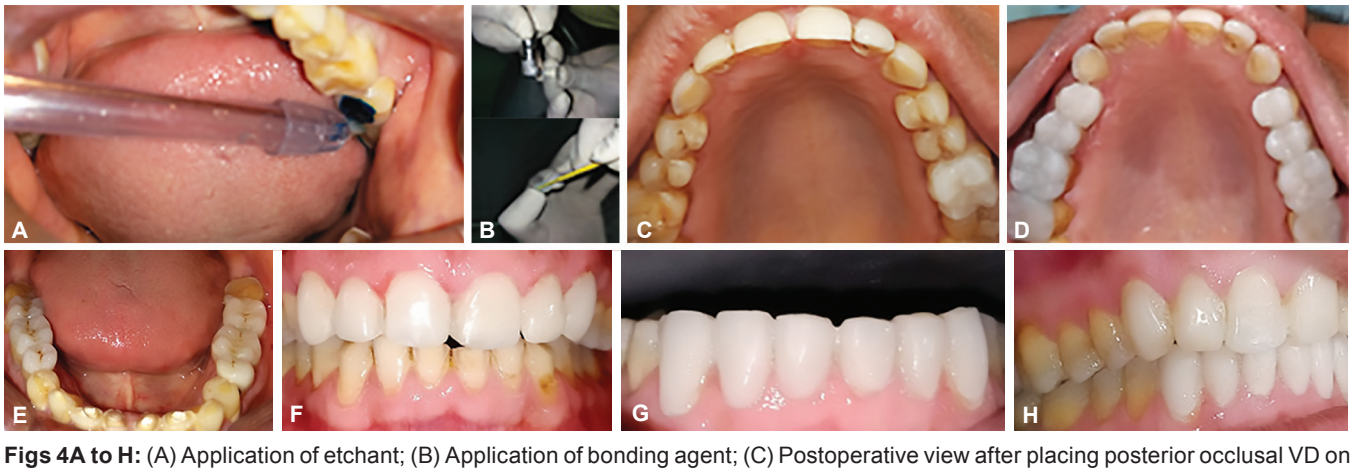
Similarly, occlusal VDs were bonded on all other posterior teeth (1st premolar to 2nd molar) in the second quadrant (Fig. 4D). Following which the excess composite was removed from the interproximal and buccolingual side of the tooth using fine finishing bur. The maxillary occlusal plane was checked in the patient's mouth using fox plane and then check cast was made for the maxillary arch to cross verify the occlusal plane and the positioning of cusps and ridges. After verification, all the veneers were finished and polished.

After the rehabilitation of the maxillary posterior teeth, the mandibular posteriors were restored in the similar manner (Fig. 4E). Articulating paper was used to check the occlusal interferences in centric and eccentric movements. They were corrected using finishing diamond and also the composite around the margin was finished and polished following which the final curing was done for 40 seconds on each side.

After restoring the lost vertical dimension at occlusion using the occlusal VDs, the anterior teeth rehabilitation was done. To start the anterior rehabilitation first the esthetics and phonetics were checked using acrylic mockup, and then the size selection for the veneer was done following which composite shade guide was used for shade selection of the composite to be used for bonding the veneer. Maxillary anterior teeth (Right canine to left canine) were first restored using the similar technique as described above (Fig. 4F). After the completion of maxillary anterior restoration, the mandibular anteriors were restored in the similar manner (Fig. 4G) with the overjet of 2 mm and the overbite of 1mm. Then the occlusion was checked in centric and eccentric movements (Fig. 4H). After verification of the occlusion final polymerization was done for 40 seconds for each veneer.

DISCUSSION

Aesthetics is a prerequisite for any dental prosthesis. The restorative dental practice has been revolutionized by recent advancements in the field of adhesive dentistry. The introduction of nano-hybrid composite resins has reinvented composite veneering technique as a conservative alternative to ceramic veneers. Excellent finishing and polishing can be achieved for composite resin materials almost simulating the esthetics of natural tooth if the clinician possesses a deep understanding of the concepts of chroma, value, hue, translucency, and opacity of the color.[3] The prefabricated composite veneering technique has many advantages such as it is minimally invasive, preservation of natural tooth structure, chair-side technique, single appointment,



Figs 4A to H: (A) Application of etchant; (B) Application of bonding agent; (C) Postoperative view after placing posterior occlusal VD on 26; (D) Postoperative view of occlusal VD on maxillary posterior teeth; (E) Postoperative view of occlusal VD on mandibular posterior teeth; (F) Postoperative after placing maxillary and anterior veneers; (G) Postoperative lateral view with anterior veneer and posterior occlusal VD; (H) Postoperative lateral view with anterior veneer and posterior occlusal VD

minimal time required to finish the treatment. The challenges include highly technique sensitive and dependent on the skill of the clinician.[4]

The correct case selection is the main factor in the clinical success of these prefabricated veneers.[5] The indications for no or minimal preparation laminate veneer include teeth resistant to bleaching, requiring morphologic modifications, closure of diastemas, minor alignment correction, enamel malformations, fluorosis, chipping, fractures, attrition, erosion, and loss of vertical dimension. Traditionally ceramic veneer would be the choice of treatment in such clinical situations, but the advances in an adhesive system which provides an excellent bond of the restorative material to both enamel and dentin along with advanced nano composite resin restorative material provides a more conservative technique for treating the cases with high esthetics and functional demands.[6]

With Edelweiss veneers and occlusions for the first time in the history of dentistry, it is now possible to work with prefabricated veneers and occlusions made from homogeneous nano-hybrid composite using modern laser technology. Selective laser sintering (SLS) is an additive manufacturing (AM) process for fabricating three-dimensional (3D) objects by adding powdered materials layer-by-layer according to computer-aided design (CAD). Laser sintering provides a homogenous, inorganic, thermally tempered and dynamic composite core with an increased surface gloss to these veneers. Based on injection moulding technology, high pressure (100 bar) is applied to condense the glass fillers before light and thermal polymerization of the Veneer and Occlusion blanks takes place. The laser treated process combines the best of two worlds: a homogenous, inorganic, and high gloss laser vitrified surface fused together with a sintered and thermally tempered (300C) dynamic composite core produces an optimal integration between function and esthetics The system also employs the natural layering technique, a concept proposed in 1995 by Professor Dr. D Deitschi. It is based on the idea of creating a synthesis between light, material and color in order to mimic the natural tooth structure. Edelweiss veneers and occlusions are polymerized, prefabricated, laser-sintered and vitrified, radiopaque,highly-filled homogenous nano-hybrid (500 nm) composite enamel shells with an inorganic surface and body. Bonding of these veneers is performed using the highly filled edelweiss direct composite to create a stable monoblock restoration (between the dentin/enamel and restorative composite and edelweiss veneer/occlusion). Final reconstruction takes place quickly and effortlessly with functional and high quality esthetic results.[1]

Edelweiss veneer system uses the latest advancement in composite resins, i.e., nanoparticle technology. Nano-sized filler particles allow greater amount of filler to be added into the composite resin matrix which are easy to shape, greater strength, abrasion resistant and also provides a smooth polished surface for the better aesthetics of the restoration. In composites containing hybrid and micro fillers, large filler particles can be easily separated from the matrix, whereas in nanocomposites only improperly attached clusters of nanofillers are separated during abrasion and therefore the restoration can easily retain its polish and smoothness for a longer time. The nanofillers that are separated from the surface of the matrix usually form defects on the surface during abrasion. But as these particles are nano-sized which is smaller than the wavelength of visible light (0.4 to 0.8 μm), it does not reflect light, and the material has higher translucency and superior optic character. Various studies have stated that restorations with smoother surfaces were achieved using composites with nanofiller compared to other composites which drastically reduces the accumulation of plaque and therefore periodontal disease.[7,8] Other *in vitro* studies have also shown that the nanofilled composites have better physical, mechanical, and aesthetic features and are an example of ideal composite restorative material.[9-11]

Unlike porcelain veneers for which at least 2 mm to 3 mm of tooth surface would have to be reduced, these prefabricated composite veneers are thinner shells of about less than 1 mm in thickness and hence, tooth reduction on the labial surface would be around 1 mm or so for it. In ceramic veneers the proximal sides have to be at right angles making sure the proximal line angles are parallel to each other. Whereas in these prefabricated veneers the proximal line angles can be rounded of as any modification can be done using composites while finishing. The mechanical properties of these prefabricated composite veneers and occlusal VDs are very much comparable to ceramics. The flexural strength is 150, 200 Mpa, compressive strength is 480, 550 Mpa, flexural modulous is 16, 19 Gpa, hardness is 80 HV, 95 HV and the polymerization shrinkage is 2.50% respectively for anterior veneer and posterior occlusal VDs. These prefabricated veneers are polishable too as they are similar to composite resins.[1]

Dietschi D, Devigus evaluated the success rate of prefabricated composite veneers based on the fatigue resistance and the success rate after 4 years of clinical service was found to be 100%.[12]

In a study conducted by Pascal et al. fatigue resistance of composite resin and ceramic posterior occlusal veneer was compared. It was concluded that posterior occlusal veneers made of composite resin had significantly higher fatigue resistance when compared to ceramics.[11]

Nuaimi and Ragab evaluated the effect of beverages on the color stability of micro filled and nanohybrid filled

resin. Color stability of nanohybrid filled resin was found better than the micro filled composite.[13]

Johnson et al. evaluated the fracture strength of CAD-CAM fabricated posterior composite and ceramics material. It was concluded that the fracture strengths of both types of occlusal veneer restorations were above the human masticatory forces.[14]

A study was done to assess the influence of CAD/CAM restorative material (ceramic vs. composite resin) on fatigue resistance of ultra-thin occlusal veneer. It was concluded that the CAD/CAM composite resin ultra-thin occlusal veneers had significantly increased fatigue resistance when compared to the ceramic.[15]

Currently, the properties of Edelweiss prefabricate veneer and OVDs indicate that they are materials capable of mimicking human enamel and their superior mechanical properties are expanding their clinical applications. The clinical success of these veneers and OVDs depends on both the suitable indications of the patient and the correct application of the materials and techniques available for that, in accordance with the goals of bio-functional aesthetics.

CONCLUSION

The system`s bio functionality and versatile area of application combined with its time and cost saving procedure make the edelweiss veneer and occlusion system a sound investment for the future. This advance can be regarded as a milestone in operative dentistry, as it will contribute tremendously to direct composite application, helping a more significant number of patients to receive esthetic restorations that are more conservative and affordable.

REFERENCES

1. Lampl S. Edelweiss dentistry. March 10 2015.http://www.edelweiss-dentristry.com/en.
2. Raskin A, Michotte-Theall B, Vreven J, Wilson NH. Clinical evaluation of a posterior composite 10-year report. Journal of dentistry. 1999;27(1):13-19.
3. Demarco FF, Collares K, Coelho-de-Souza FH, Correa MB, Cenci MS, Moraes RR, Opdam NJ. Anterior composite restorations: A systematic review on long-term survival and reasons for failure. Dental Materials. 2015;31(10):1214-1224.
4. Drummond JL. Degradation, fatigue, and failure of resin dental composite materials. Journal of dental research. 2008 Aug;87(8):710-719.
5. Ferracane JL. Resin-based composite performance: are there some things we can't predict?. Dental materials. 2013;29(1): 51-58.
6. Goodridge RD, Tuck CJ, Hague RJ. Laser sintering of polyamides and other polymers. Progress in Materials science. 2012;57(2):229-267.
7. Jasdeep K, Kirandeep K, Geeta A, Kumar SL. Nanotechnology in Dentistry. World Journal of Pharmacy and Pharmaceutical Sciences 2015;5(4): 570-582.
8. Manicone P F, Rossi J P, Raffaeli L. An overview of zirconia ceramics. Basic properties and clinical application. Journal of Dentistry 2007;35:819-826.
9. Guess PC, Schultheis S, Bonfante EA, Coelho PG, Ferencz JL, Silva NR. All-ceramic systems: laboratory and clinical performance. Dental Clinics. 2011;55(2):333-352.
10. Vagkopoulou T, Koutayas SO, Koidis P, Strub JR. Zirconia in dentistry: Part 1. Discovering the nature of an upcoming bioceramic. Eur J Esthet Dent. 2009 Summer;4(2):130-151.
11. Magne P, Schlichting LH, Maia HP, Baratieri LN. In vitro fatigue resistance of CAD/CAM composite resin and ceramic posterior occlusal veneers. The Journal of prosthetic dentistry. 2010;104(3):149-157.
12. Rocca GT, Gregor L, Sandoval MJ, Krejci I, Dietschi D. In vitro evaluation of marginal and internal adaptation after occlusal stressing of indirect class II composite restorations with different resinous bases and interface treatments."Post-fatigue adaptation of indirect composite restorations". Clinical oral investigations. 2012 Oct 1;16(5):1385-1393.
13. Nuaimi HO, Ragab HM. Effect of aggressive beverage on the color stability of different nano-hybrid resin based composite. European Journal of General Dentistry. 2014;3(3): 190-193.
14. Johnson AC, Versluis A, Tantbirojn D, Ahuja S. Fracture strength of CAD/CAM composite and composite-ceramic occlusal veneers. Journal of prosthodontic research. 2014;58(2): 107-114.
15. Egbert JS, Johnson AC, Tantbirojn D, Versluis A. Fracture strength of ultrathin occlusal veneer restorations made from CAD/CAM composite or hybrid ceramic materials. Oral Science International. 2015;12(2):53-58.