

Direct composite resin crown fabrication on a custom formed root canal post – EverStick®POST

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SUMMARY

Objective. EverStick glass fibre posts have been advocated for a new method of a direct post and core fabrication. The EverStick posts have adhesive surface and are flexible before curing therefore can be shaped individually. The purpose of this article is to describe a new technique of direct composite resin crown fabrication on a custom made EverStick root canal post.

Methods. At first a rubber dam isolation was achieved and the EverStick post was fabricated following manufacturer's instructions. The crown fabrication started from the palatal layer of composite resin (Gaenial JE, GC) which was applied by means of a silicon index and light cured for 20 seconds (G-Light, GC). A dual cure self-adhesive resin cement (G-CEM Link Ace A2, GC) was used to cement the post and light cured for 40 seconds. Two further layers of Gaenial in AO2, A2 shades were placed to obtain the dentin shape and shade of the crown. For the enamel layer of the restoration Gaenial BW shade was used. Each layer was light cured separately for 20 seconds. The restoration was polished with diamonds (NTI-KAHLA GmbH, Germany) under water cooling. The final gloss was achieved by means of Soft-Lex discs (3M ESPE, USA) and a polishing paste (Gradia diapolisher, GC).

Results. The results achieved after 3 days and 12 months showed satisfactory aesthetics and marginal integrity of the restoration.

Conclusion. Direct composite resin crown fabrication on a custom formed root canal post could be used as an economical and conservative treatment option.

Keywords: direct composite resin restorations, root canal posts, endodontically treated teeth.

INTRODUCTION

Restorations of endodontically treated teeth represent a big part of modern restorative treatment. A post and core should be fabricated to provide retention for the coronal restoration – most often an indirectly made crown. The clinical procedure requires deep knowledge and expertise of the practitioner (1). However, there is a big diversity and controversy of literature as to what techniques and materials would provide better results (1, 2). Literature reports high failure rate of endodontically treated teeth due to the mistakes made by dentists (3, 4).

Traditionally metal cast post and core systems have been used. Literature reports high success rate

and therefore the systems are widely used (5,6). Advantages of the cast metal structures are their strength and individual fit. However, it is essential to leave an adequate amount of dentin for support and distribution of stress forces from the post. Fabrication of a cast post and core requires two appointments and a dental laboratory work involved. The big disadvantage of the rigid structures like metal or ceramics is their high modulus of elasticity (200 GPa of metal posts, 150 GPa of ceramic posts). High modulus of elasticity of the post may cause the uneven stress distribution between the post and dental tissues resulting in fracture of the weaker material-dental tissues (7, 8). Therefore alternative systems of standard fiber posts were introduced. The fiber posts have modulus of elasticity closer to that of dentin (fiber post=20 GPa, dentin 18=GPa). Thermal and mastication stress forces are therefore more evenly distributed between the post and dental tissues (9, 10). The use of prefabricated posts is cheaper and less time consuming than cast posts. The standard posts are round in cross section and therefore are best suited for canals

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Fig. 1. Initial clinical image: fracture extending subgingivally on the mesial surface

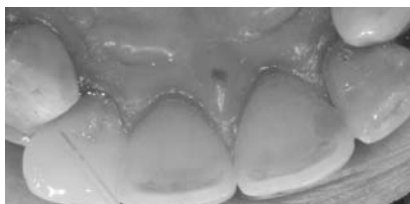


Fig. 2. A direct composite resin mock-up of palatal and incisal surfaces was fabricated



Fig. 3. To obtain a silicon index of palatal and incisal surfaces an impression with putty material was taken



Fig. 4. A rubber dam is inverted in the gingival sulcus. The remaining tooth tissues are isolated and exposed for the adhesive procedure



Fig. 5. The custom made post formation: first additional post was added to the main post. An empty space in the orifice will be filled with a second additional post

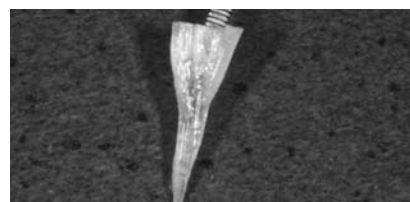


Fig. 6. The custom made post after it was removed from the canal. The post is still flexible and should be protected from ambient light before cementation

which are circular in cross section. It is well known that the shape of root canals is often not circular (11, 12). Therefore the preformed drills should be used to prepare a cylindrical cavity for the preformed posts sacrificing sound dentin tissue which may lead to an increased risk of root perforation or fracture (13, 14). Many attempts to improve the adaptation of preformed fiber posts to the canal anatomy have been tested, such as combining small multiple post in a single root canal (15), relining a preformed fiber post in combination with a dual-curing resin cement to create an anatomical post (16), modelling cylindrical fiber posts to give them a shape closer to the shape of oval root canals through the use of a diamond bur (15, 16), or using prefabricated glass fiber posts with an oval cross-section in combination with a dual-curing composite resin core material in premolars presenting an oval root canal cross-section (17).

Most often the post and core systems are used to retain indirect restorations which are cemented or adhesively bonded because neither cast metal neither prefabricated fiber posts possess adhesive surface.

Recently a new type of adhesive and flexible fibre posts was introduced. The posts are made of silanated glass fibers in thermoplastic polymer and light curing resin matrix. The patented resin mixture is called interpenetrating polymer network structure (IPN) (18). The IPN structure is responsible for proper bonding between the post surface and a restorative or luting composite resin. The IPN structure also makes EverStick posts flexible and sticky before light curing (19). Because of the flexibility, good IPN bond with direct composite resins and remaining tooth tissues EverStick post

could be very useful for direct aesthetic restorations of anterior teeth.

Based on the presented clinical case and literature review this article describes the direct composite layering technique on the new type of adhesive and flexible post.

MATERIALS AND METHODS

A 62-year-old female patient came to the dental clinic after a traumatic incident complaining of full crown fracture of tooth 12 (Figure 1). A clinical examination revealed full crown fracture extending subgingivally on the mesial surface. The root canal orifice was covered with a broken composite filling. A radiographic examination showed an adequate root canal filling. The following treatment plan was advised:

- A direct composite restoration on a custom made glass fiber post;
- Follow up recalls.

For the restoration build up a microhybrid resin composite Gaenial with a self-etching, light-cured bonding system Gaenial Bond (GC Corporation, Tokyo, Japan) were used.

An anatomical composite layering technique based on recreation of dentin and enamel in natural thickness was chosen (20). For the colour determination a custom made shade guide (GC Corporation, Tokyo, Japan) was used. The value of the tooth colour was determined first while hue and chroma in the second stage (20).

A direct composite resin mock-up (Gaenial, GC) of palatal and incisal surfaces was fabricated to



Fig. 7. To insure a passive fit palatal part of the silicone index was removed



Fig. 8. Gaenial JE was used to form the palatal layer. To insure initial stability a little quantity of the composite resin was pushed and adapted in the canal orifice area



Fig. 9. To avoid too high translucency a thin layer of opaque Gaenial AO2 was applied in the central area of the restoration.



Fig. 10. To achieve a desired flat coronal shape the custom made post was pushed gently against the palatal wall and light cured



Fig. 11. Gaenial AO2 and A2 shades were used to obtain dentin shape and color



Fig. 12. Gaenial BW shade was used to form the enamel layer

obtain a silicon index (Exafast Putty, GC) (21-23) (Figures 2, 3).

On the same appointment 6 upper anterior teeth were isolated with a medium weight green rubber dam (Roeko, Coltene/whaledent D-89122, Langenau/Germany). To make the subgingival root area accessible a gingival retraction was achieved by means of a dental teflon tape and floss ligature (Figure 4). Two thirds of the root canal filling were removed with Gates Glidden drills in a minimally invasive way, the root canal was washed with air-water spray and dried with paper points. A custom made EverStick post fabrication was started directly in the root canal (Figure 5) by adjusting the main post with diameter of 1.5 mm. The main post was tapered with scissors to fit the apical area of the canal. The root canal orifice area was filled with two additional EverStick posts to increase the strength and dislodgement resistance. The IPN structure provides EverStick posts with a sticky adhesive surface which allows to form the final core build-up as one solid anatomical structure. When the desired volume and shape of the post were reached it was removed from the root canal by tweezers (Figure 6). Since the light cured component of the IPN is ambient light sensitive the post was protected under a black cover before it would be cemented and light cured in the root canal.

Before cementing the post a correct inclination of the coronal part had to be determined. This was done by the first layer of composite resin forming the palatal wall which was applied in the silicone index. To insure a passive fit of the silicone index on the rubber dam isolated teeth, palatal part of the index was removed (Figure 7). After etching and bonding procedure adjacent teeth were isolated with a teflon

tape to prevent sticking of the composite resin. The first, palatal layer of a translucent composite material (Gaenial JE, GC) was applied by means of the silicon index and light cured for 20 seconds (G-Light, GC Corporation) (Figure 8). To block the translucency of the post in the central area of the restoration a thin layer of opaque composite (Gaenial AO2) was applied but not light cured since this may have interfered with the post introduction during cementation (Figure 9). An A2 shade of dual cured self-adhesive resin cement (G-CEM Link Ace, GC) was syringed into the canal by means of a fin mixing tip. At this stage the post was introduced in the canal, gently pushed against the palatal wall to flatten the coronal part and insure a good adaptation. It was light cured for 40 seconds from each facial, palatal and incisal directions for 40 seconds. Since it was not necessary to remove cement surplus by bur air inhibition layer all over the adhesively treated surface was preserved and no adhesive system was used for further layering of the restoration (Figure 10). Isolating teflon tapes were replaced with transparent straight matrix band strips (KerrHawe SA, 6934, Bioggio/ Switzerland). To obtain a dentin colour of the restoration two further layers of Gaenial in AO2 and A2 shades were applied, shaped by means of a flat modelling brush (Gradia flat brush, GC) and light cured for 20 seconds each (Figure 11). Enamel of the adjacent teeth was determined as not very transparent but white, therefore for the outermost layer of the restoration Gaenial BW shade was used (Figure 12). The restoration was polished with diamonds (NTI-KAHLA GmbH, Kahla, Germany) at moderately high speed, low pressure and under water cooling. The final gloss was achieved by means of



Fig. 13. Final clinical image three days after the restorative procedure. The gingival condition shows incomplete healing after the removal of surplus material in the cervical area

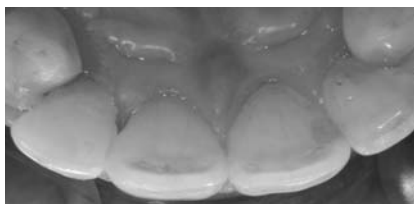


Fig. 14. Final clinical image three days after the restorative procedure- palatal surface view



Fig. 15. The 12-month post-operative view. A gingival inflammation can be seen



Fig. 16. The 12-month post-operative view on the palatal surface. Good gingival condition can be seen

Soft-Lex discs (3M ESPE Dental Products, St. Paul, MN 55144-1000 USA) and a polishing paste (Gradia diapolisher, GC Corporation, Tokyo, Japan).

RESULTS

The results achieved after 3 days can be seen on the photographs (Figures 13,14). The restoration shows a satisfactory aesthetics and marginal integrity. At 12 months recall check-up photographs were taken (Figures 15, 16). The patient had no complains on aesthetics or function of the restoration. A clinical examination revealed good colour stability of the restoration but there was some gingival inflammation on the facial surface of the restoration. The patient explained she was “preserving” the restoration from a tooth brushing. She was advised to clean this area with a soft dental brush just as strong as all the other areas were cleaned.

DISCUSSION

Custom made glass fiber posts have several advantages comparing to cast metal or prefabricated posts, especially when used to retain direct composite restorations. Prefabricated posts require a root canal preparation made by standard cylindrical burs which may weaken the remaining tooth structure. Moreover, in clinical situations with big tissue loss this type of preparation cannot provide good fit and stability in the pulp chamber-canal orifice area. Any posts cannot be used in curved canals.

EverStick posts can be shaped individually by filling the pulp chamber completely with fibres and strenght would be maximised in the most critical area.

It is evident individually formed posts has better resistance to rotational forces and dislodgement in comparison to standard glass fiber or metal posts (24). EverStick posts can be used in curved canals because they are flexible during cementation procedure and can bend to follow the canal curvature. The

fibers allow good light transmission and therefore posts can be cured in curved canals.

Coronal part of natural frontal teeth is flat therefore the round in cross section prefabricated post may interfere with aesthetic layering of a direct composite resin restoration and has to be adjusted by grinding. However this may decrease the retentive surface area of the post. Prefabricated posts are not adhesive itself and therefore complex adhesive procedures have to be used to insure retention of a direct composite resin restoration.

Because of the IPN structure EverStick posts have good bonding with direct composite restorations enabling reliable surface retained applications. Flexibility before light curing enables desired shape adjustments of the post. This is done simply by stretching or pushing the fibers. Moreover an inclination of the core can be adjusted by bending it to the desired direction while light curing.

Aesthetic result of a single tooth could be easier achieved using a direct restorative technique because it allows natural looking colour modifications. EverStick posts are too translucent but the translucency can be blocked by using proper composite opacities in the layered restoration. Cast meal posts are not suitable for metal free direct or indirect restorations because of their anaesthetic appearance and a complex adhesive procedure needed to bond the restorations.

CONCLUSIONS

As a result of the presented clinical case, the literature review and 3 year authors' clinical experience with EverStick products, following conclusions can be made.

The custom made EverStick posts provide a reliable retention for direct/ indirect restorations of endodontically treated teeth.

The posts can be used in short and wide or curved root canals, were prefabricated posts cannot insure adequate retention.

Filling a pulp chamber with additional post is of paramount importance to strengthen the most critical area of the custom made post.

Direct composite resin crown fabrication on the custom formed root canal post could be used as

an economical alternative for long term temporary restorations.

Scientific evidence especially based on results of clinical studies is needed to validate his method to be used for permanent restorations.

STATEMENT OF CONFLICT OF INTEREST

V. V. is engaged under consulting agreement with GC Nordic AB.

J. Ž. declares that he has no conflict of interests.

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