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(54) Title: HYBRID DENTAL POST SYSTEM

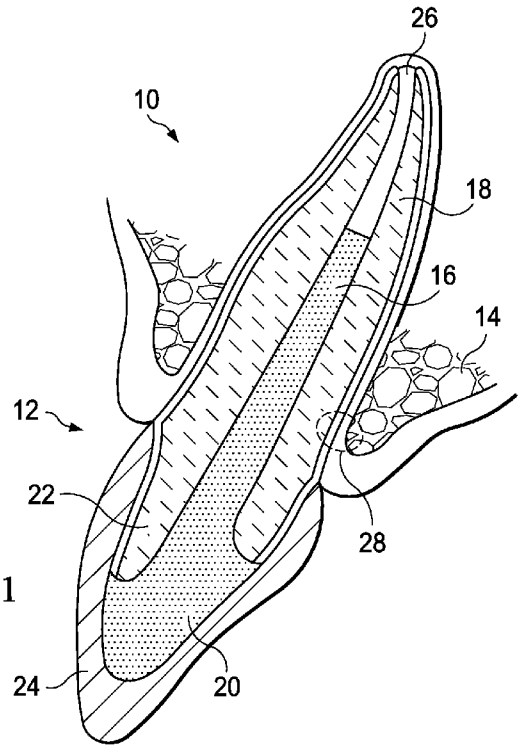

FIG. 1

(57) Abstract: A dental post system (100, 200) includes a core (104, 204) having an outer surface and a thermoplastic coating (108, 208) on the outer surface. The thermoplastic coating (108, 208) includes a flexible polymer having different material properties than the underlying supporting core (104, 204). Heat, bonding agents or other plasticizers adapt the thermoplastic coating (108, 208) for fitting into the shape of the drilled root canal while the rigid core (104, 204) is relatively unaffected. Methods include plasticizing the coating before inserting the dental post system into a tooth canal, bonding the coating, the core, the resin cement and the tooth canal, and re-plasticizing the coating or dissolving the coating after insertion and retrieving the dental post system.

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HYBRID DENTAL POST SYSTEM

The present application claims the benefit of U.S. Provisional Application No. 61/028,238, which was filed on February 13, 2008 and entitled "Hybrid Dental Post System."

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable.

BACKGROUND

Technical Field

The present disclosure generally relates to apparatus and methods for endodontically restoring a tooth, and, more particularly, to the post, core and their luting or bonding agents which together form a foundation restoration to support a coronal restoration for the endodontically treated tooth.

The post, the core, and their luting or bonding agents together form an artificial foundation to support a coronal restoration for the endodontically treated tooth. A dental post is used as a foundation to restore a fractured tooth or a tooth with extensive decay. A dental post generally includes a metallic retentive part. It is placed as far down as possible into the post space inside the root canal and cemented with permanent cement. The bonded or cemented post extends coronally from the root to anchor the core. The purpose of the post is to retain the core and consequently the crown. It also helps protect the apical seal from bacterial contamination caused by coronal leakage. The post should perform both of these functions without increasing the risk of root fracture. The post itself typically does not strengthen or reinforce a tooth. The inherent strength of the tooth and its resistance to root fracture comes from the remaining tooth structure and the surrounding alveolar bone. The tooth is weakened if dentin is sacrificed to place a larger diameter post.

Description of Related Art

Restorations for the endodontically treated tooth are designed to protect the remaining tooth from fracture, prevent re-infection of the root canal system and replace the missing tooth structure. The final configuration of a fully restored tooth may have five parts. With reference to Figure 1 (drawing copied from "Pathways of the pulp," Cohen, S. and Hargreaves, K., Mosby, 2006 with lead lines and reference numerals added), a restored tooth 10 may include residual coronal and radicular tooth structure 12, 28, supported by the periodontium 14. A post 16 is disposed in a root 18 of the tooth 10. A core 20 is disposed in

a pulp chamber 22 in the coronal area of the tooth 10, and a final coronal restoration 24 completes the tooth 10. The post 16 supports the core 20 which, in turn, supports the coronal restoration 24. Adhesive bonding agents or traditional luting cement may couple or join the various components. At the apical end of the tooth 10, an endodontic seal 26 may be preserved with three to five millimeters of gutta-percha. Restorative endodontic therapy is intended to preserve the residual root 28 and its attachment mechanism.

Referring now to Figure 2 (drawing copied from "Pathways of the pulp," Cohen, S. and Hargreaves, K., Mosby, 2006 with lead lines and reference numerals added), the endodontically treated and restored tooth 10 may include the post 16 that is placed as far down as possible into the post space inside the canal 32 of the root 18. The post 16 may then be bonded or cemented into the root canal 32. The post 16 extends coronally to anchor the core 20 and, consequently, the crown 24. The post 16 also helps protect the apical seal 26 from bacterial contamination caused by coronal leakage. The post 16 should perform these functions without increasing the risk of root fracture. The post itself typically does not strengthen or reinforce the tooth; rather, the inherent strength of the restored tooth and its resistance to root fracture derives from the remaining tooth structure and the surrounding alveolar bone. The tooth is weakened if dentin is sacrificed to place a larger diameter post. Some of the recognized clinical features a dental post should include are: maximum protection of the root from fracture, maximum retention within the root and retrievability of the post, maximum retention of the core and crown, maximum protection of the crown margin seal from coronal leakage, good aesthetics, high radiographic visibility and biocompatibility.

Nonetheless, failure of post-retained crowns is relatively common, as related in numerous clinical studies known to those skilled in the art. For example, see Bergman, B., P. Lundquist, et al. (1989), "Restorative and endodontic results after treatment with cast posts and cores", J Prosthet Dent 61(1), 10-5; Mentink, A. G., R. Meeuwissen, et al. (1993), "Survival rate and failure characteristics of the all metal post and core restoration", J Oral Rehabil 20(5), 455-61; Roberts, D. H. (1970), "The failure of retainers in bridge prostheses. An analysis of 2,000 retainers", British Dental Journal 128(3), 117-124; Sorensen, J. A. and J. T. Martinoff (1984), "Intracoronal reinforcement and coronal coverage: a study of endodontically treated teeth", J Prosthet Dent 51(6), 780-4; and Torbjorner, A., S. Karlsson, et al. (1995), "Survival rate and failure characteristics for two post designs," J Prosthet Dent 73(5), 439-44.

Therefore, it is desirable to decrease the risk of tooth fracture by lessening the effects of metal or other rigid posts in endodontic restorations. A rigid post resists forces applied thereto and transfers the stresses to the less rigid tooth substance, thus causing failure of the tooth structure. It is therefore desirable to lessen the effect of post rigidity. It is also desirable to lessen the effect of opaque posts and cores on aesthetics of the restored tooth. If a retreatment is required, it is very desirable to lessen the effects of post removal, such as time and trauma to the patient.

SUMMARY

In exemplary embodiments, a dental post system includes a core having an outer surface, the core configured for placement in a tooth root canal, and a thermoplastic coating on the outer surface, the thermoplastic coating adaptable to an opening in the tooth root canal. In some embodiments, the thermoplastic coating is adaptable in response to a plasticizer. In some embodiments, the core includes a material property greater than the same material property of the thermoplastic coating. In some embodiments, the material property is any one or more of a melting point and an Elasticity Modulus. In some embodiments, the core includes a flexibility approximating the flexibility of dentin. In some embodiments, the core includes an Elasticity Modulus of between 20 and 100 GPa. In some embodiments, the system includes a plasticizer for adapting the thermoplastic coating to the shape of the opening in the tooth root canal.

In some embodiments, the thermoplastic coating includes a flexible polymer. In some embodiments, the thermoplastic coating includes any one or more of polyamide, aramid, polyster, polyaramid, acrylic, polyurethanes, epoxy-based resins, polyacetals, vinyl and modacrylic, polyolefin, polytetraflurethylene and their copolymers. In some embodiments, the thermoplastic coating includes any one or more of a plasticizing agent, antibiotics, cariostatics, and antibacterially and biologically active materials. In some embodiments, the core includes any one of Pd, Pt, Rh, Ir, Au, Ag, Ti, Co, Mo, AgPd, AuPtPd, TiAlFe, TiAlV, CoCrMo, steel, brass and fiber reinforced composites. In some embodiments, the core is metallic.

In some embodiments, the core includes a first taper that is greater than a second taper of the thermoplastic coating. In some embodiments, the core includes an inner passage. In some embodiments, the core includes perforations. In some embodiments, the core and the thermoplastic coating are bonded by at least one of mechanical and chemical means. In some embodiments, the outer surface of the core is treated by at least one of mechanical and chemical means.

In exemplary embodiments, a dental post system includes a rigid core having an outer surface, the rigid core configured for placement in an opening in a tooth root canal, a less rigid

thermoplastic coating coupled to the outer surface, and a plasticizer applied to the thermoplastic coating causing the thermoplastic coating to adapt to the shape of the opening in the tooth root canal. In some embodiments, the plasticizer plasticizes the thermoplastic coating but does not plasticize the core. In some embodiments, the system includes a resin cement to fill a gap between the dental post system and a tooth dentin. In some embodiments, the resin cement is adapted to create a bond between the dental post system and the tooth root canal. In some embodiments, the system includes an increased volume of thermoplastic material at an apical portion of the core. In some embodiments, the core, the thermoplastic coating, the resin cement and the dentin are bonded to form a monoblock foundation for a tooth restoration.

In exemplary embodiments, a method of implanting a dental post system includes providing a flexible thermoplastic coating on an inner rigid core, inserting the rigid core and the coating into an opening in the tooth root canal, plasticizing the thermoplastic coating, and adapting the plasticized coating to a shape of the opening in the tooth root canal. In some embodiments, the rigid core is not plasticized. In some embodiments, the plasticizing is achieved by any one or more of heating the coating, applying a bonding agent to the coating, and applying a reaction agent to the coating. In some embodiments, the method includes filling a gap between the coating and the opening in the tooth root canal with a resin cement. In some embodiments, the method includes bonding the coating, the core, the resin cement and the tooth root canal to form a monoblock foundation for a tooth restoration after the insertion step. In some embodiments, the method includes applying a restoration to the dental post system. In some embodiments, the method includes retrieving the dental post system by any one or more of re-plasticizing the coating, dissolving the coating, and unscrewing the core.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross-section view of a restored endodontically treated tooth with one configuration of a post and a core.

Fig. 2 is a cross-section view of a restored endodontically treated tooth with another configuration of a post and a core.

Fig. 3 is a side view of an embodiment of a dental post system in accordance with principles of the disclosure.

Fig. 3A is a side, enlarged view of the post system of Figure 3 with phantom and cutaway portions to show the inner core and the flexible thermoplastic outer coating.

Fig. 3B is a top view of the post system of Figure 3.

Fig. 3C is a cross-section view of the post system of Figure 3 taken at the section C-C.

Fig. 3D is the view of Figure 3A including indications of taper.

Fig. 4 is a side view of another embodiment of a dental post system in accordance with principles of the disclosure.

Fig. 4A is a top view of the post system of Figure 4.

Fig. 4B is a cross-section view of the post system of Figure 4 taken at the section B-B.

Fig. 4C is a cross-section view of the post system of Figure 4 taken at the section C-C.

NOTATION AND NOMENCLATURE

In the following discussion and in the claims, the terms "comprising," "including" and "containing" are used in an open-ended fashion, and thus should be interpreted to mean "including, but not limited to…".

The singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise.

The term "about," when used in the context of a numerical value, means approximately or reasonably close to the given number, and generally includes, but is not limited to, ± 10% of the stated number.

The term "endodontic," or forms thereof, means pertaining to the tooth root, root canal, pulp and pulp cavity and surrounding tissue.

The term "apical," or forms thereof, means pertaining to the apex of the root of a tooth, or that portion of a restorative component disposed adjacent or directed toward the apex of the root of a tooth.

The term "coronal," or forms thereof, means pertaining to the end of a tooth opposite the apex of the root, or the crown end of a tooth, or that portion of a restorative component disposed adjacent or directed toward the crown.

DETAILED DESCRIPTION

In the drawings and description that follow, like parts are typically marked throughout the specification and drawings with the same reference numerals. The drawing figures are not necessarily to scale. Certain features may be shown exaggerated in scale or in somewhat schematic form and some details of conventional elements may not be shown in the interest of clarity and conciseness. The present disclosure is susceptible to embodiments of different forms. Specific embodiments are described in detail and are shown in the drawings, with the understanding that the present disclosure is to be considered an exemplification of the principles of the disclosure, and is not intended to limit the disclosure to that illustrated and described

herein. It is to be fully recognized that the different teachings of the embodiments discussed below may be employed separately or in any suitable combination to produce desired results.

The present disclosure includes embodiments of an endodontic post. In some embodiments, the post includes a core coated with a flexible thermoplastic material. The post may also be referred to as a hybrid dental post system or a hybrid post and core.

Referring initially to Figure 3, a side view of a post system 100 includes a body 102 having a lower core 104 and an upper core 106. In various embodiments, the lower core 104 is made from a material including, but not limited to, Pd, Pt, Rh, Ir, Au, Ag, Ti, Co, Mo, AgPd, AuPtPd, TiAlFe, TiAlV, CoCrMo, steel, brass and fiber reinforced composites. In some embodiments, the lower core 104 is made from a non-toxic substance having a flexibility that approximates the flexibility of dentin. In some embodiments, the lower core 104 includes an Elasticity Modulus between 20 and 100 GPa. In some embodiments, the flexibility of the core 104 is adjusted by changing the thickness or the material of the core 104, or a combination thereof. In exemplary embodiments, the upper core 106 is also made from the above-listed materials or includes the listed properties.

Still referring to Figure 3, the lower core 104 is coated or layered with a flexible thermoplastic material 108, shown in partial phantom for viewing the underlying inner core 104. Referring to Figure 3A, an enlarged view of the lower core 104 shows the thermoplastic layer 108 in partial phantom, and also enlarged, with an upper portion of the layer 108 removed to show the core 104 in full view. Figure 3B shows a top view of the upper core 106. Figure 3C shows a top-down view of cross-section C-C in Figure 3. The core 104 is surrounded by the thermoplastic layer 108. In some embodiments, the core 104 includes a larger taper as compared to the taper of the layer 108. For example, with reference to Figure 3D, the core 104 may have a taper 112 having a taper value of 0.08 while the layer 108 includes a taper 110 having a taper value of 0.04. The taper values are calculated by subtracting the minimum diameter from the maximum diameter for each of the core 104 and the layer 108, and dividing each resulting number by the length of the post body 102.

Referring next to Figure 4, an alternative post system 200 includes an inner core 204 and an outer thermoplastic layer 208 surrounding the core 204. In some embodiments, the post system includes a channel or passage 220 through the core 204, making the core 204 hollow, as shown in the top-down view of Figure 4A, the view of Figure 4B taken at the section B-B of Figure 4, and the view of Figure 4C taken at the section C-C of Figure 4C. In some embodiments, the core 204 includes apertures or perforations 230.

The flexible thermoplastic coatings 108, 208 may be formed from different polymers or combinations thereof. For example, embodiments of the coatings include, but are not limited to, polyamide, aramid, polyster, polyaramid, acrylic, polyurethanes, epoxy-based resins, polyacetals, vinyl and modacrylic, polyolefin, polytetraflurethylene and their copolymers. In other embodiments, the plastic coatings may include additives typical in the dental field such as a plasticizing agent, antibiotics, cariostatics, or antibacterially and biologically active materials. In exemplary embodiments, the thermoplastic coatings 108, 208 are adapted to receive a plasticizer for plasticizing the coatings 108, 208.

The cores 104, 204 are formed from materials having various combinations of properties including, but not limited to, non-toxic, FDA approved, flexibility approximating the flexibility of dentin, and an Elasticity Modulus between 20 and 100 GPa. For example, the cores may include, but are not limited to, Pd, Pt, Rh, Ir, Au, Ag, Ti, Co, Mo, AgPd, AuPtPd, TiAlFe, TiAlV, CoCrMo, stainless steel, brass and fiber reinforced composites. In some embodiments, the cores 104, 204 are metallic. In some embodiments, the flexibility of the cores 104, 204 are adjusted by changing the thickness or the material of the cores 104, 204, or a combination thereof. In exemplary embodiments, a material property of the cores 104, 204 is greater than the same material property of the surrounding thermoplastic layers 108, 208. For example, the material of the cores 104, 204 includes a higher Elasticity Modulus or melting point than the surrounding thermoplastic layers 108, 208, as will be discussed more fully below. In exemplary embodiments, a plasticizer will plasticize the layers 108, 208 while the cores 104, 204 will resist the plasticizing effects of the plasticizer.

In operation, a post system 100, 200, or equivalents, is inserted into an opening in the tooth root canal. The opening may be created by a dental drill. A plasticizer is applied to the post system 100, 200. In exemplary embodiments, the plasticizer is heat and the thermoplasticizing of the coating 108, 208 is executed inside the root canal by a commercially available heat carrier. In exemplary embodiments, the post system 100, 200 is heated in an oven outside the root canal, and passively placed inside the canal after thermoplasticizing the plastic coating 108, 208. The higher melting point of the cores 104, 204 relative to the thermoplastic coatings 108, 208 allows plasticizing of the outer coatings 108, 208 while the supporting cores 104, 204 do not plasticize, or otherwise resist the higher temperatures. In exemplary embodiments, the plasticizer is a bonding agent or other reaction agent applied to the coating 108, 208 before or after insertion of the post system 100, 200. Thus, the plasticizer will change a material property of the coating 108, 208 while the same material property of the core 104, 204 will remain unchanged. Consequently, the post system is adapted to be in close

proximity to the inner surface of the tooth root canal, and activation of the heat carrier or oven, or application of the reaction agent, will plasticize the coating. The thermoplastic coating allows the post system to adapt, contour or form fit to the inner shape of drilled openings in root canals without further preparation of the canal. The polymeric coatings 108, 208 also function as a shock absorber to release stresses and forces that are otherwise applied to the inside of the tooth root canal during post placement.

In some embodiments, the post system is placed passively inside the tooth canal and a resin cement fills the gaps between the post system and dentin. The post system is intended to bond to the root canal surface using the resin cement, and the core is subsequently built up with proper materials. In some embodiments, the core is more tapered than the overall post body having the polymer coating; therefore, there is more flexible material at the apical portion of the post body. Increased plastic volume at the apical portion of the post system allows the post system to adapt better to root canals without further preparation of the canal.

After the post system is securely placed within the tooth root canal, it provides enough anchorage and retention to enable a crown to be restored. The composition of the post system, and of the core, also desirably affects core retention. A post system that retains a core of a different material compared to another component, such as the outer coating, is at risk for separation of the core from the overall post system. A post system consistent with the teachings herein integrates the post and core components into a system that eliminates this interface that is at-risk of separation. The dentin, the resin cement, the polymer coating and the core components of the post systems disclosed herein together form a strong uniform or monoblock foundation restoration. The bond between the plastic coating and the inner core is achieved through mechanical or chemical means, or by a combination of both. The surface of the core may be treated mechanically and chemically to provide better adhesion between the core and the plastic coating. The integration of the post and core concepts into the post systems described herein may also be referred to as a hybrid dental post.

The core provides a strong foundation that extends apically to anchor the materials used to support the crown. The core can be hollow, as shown in Figures 4-4C, or solid, as shown in Figures 3-3D.

The plastic coating operates as a stress breaker to distribute forces applied to the post system more evenly during post placement. The post system's ability to anchor the core is critically important for successful reconstruction of the endodontically treated tooth. Loss of core retention results in loss of the crown. Retention of the post in the root and to the core is a reflection of the bonding process and inherent strength of the post system as disclosed herein.

A debonded or fractured post cannot retain the core and crown. A post system according to the various embodiments described herein can chemically bond to dentin and retain direct cores by a combination of adhesive or mechanical means.

As described, the plastic coating can chemically bond indirectly to dentin and increase the retention of the post inside the canal. Nonetheless, if retreatment is required, the post system can be retrieved by first heating the core to plasticize the coating, or, alternatively, by dissolving the coating in an organic solvent, or simply unscrewing the core.

With the systems and methods described herein, a dental post system can be placed in less time. The placement of the dental post system can be done without lab work. The dental post system can be inserted immediately upon the decision to use it. The dental post system significantly reduces the amount of force transmitted to the tooth root structure. The dental post system significantly reduces the amount of tooth root structure lost at the internal wall of the root canal. The dental post system significantly increases retention of the post system within the root canal. The dental post system can be adapted to the root canal by applying heat, bonding agents or other plasticizers, which will advantageously affect the outer layer while the inner core made from different materials will be relatively unaffected. The dental post system can be removed from the root canal by applying heat, a polymer solvent or by unscrewing the core. A one size dental post system can be adapted to different size root canals.

While specific embodiments have been shown and described, modifications can be made by one skilled in the art without departing from the spirit or teaching of this disclosure. The embodiments as described are exemplary only and are not limiting. Many variations, modifications and combinations are possible and are within the scope of the disclosure.

CLAIMS

What is claimed is:

1. A dental post system comprising:

a core having an outer surface, the core configured for placement in a tooth root canal; and

a thermoplastic coating on the outer surface, the thermoplastic coating adaptable to an opening in the tooth root canal.

2. The dental post system of claim 1 wherein the thermoplastic coating is adaptable in response to a plasticizer.

3. The dental post system of claim 1 wherein the core includes a material property greater than the same material property of the thermoplastic coating.

4. The dental post system of claim 3 wherein the material property is any one or more of a melting point and an Elasticity Modulus.

5. The dental post system of claim 1 wherein the core includes a flexibility approximating the flexibility of dentin.

6. The dental post system of claim 1 wherein the core includes an Elasticity Modulus of between 20 and 100 GPa.

7. The dental post system of claim 1 further including a plasticizer for adapting the thermoplastic coating to the shape of the opening in the tooth root canal.

8. The dental post system of claim 1 wherein the thermoplastic coating includes a flexible polymer.

9. The dental post system of claim 1 wherein the thermoplastic coating includes any one or more of polyamide, aramid, polyster, polyaramid, acrylic, polyurethanes, epoxy-based resins, polyacetals, vinyl and modacrylic, polyolefin, polytetraflurethylene and their copolymers.

10. The dental post system of claim 1 wherein the thermoplastic coating includes any one or more of a plasticizing agent, antibiotics, cariostatics, and antibacterially and biologically active materials.

11. The dental post system of claim 1 wherein the core includes any one of Pd, Pt, Rh, Ir, Au, Ag, Ti, Co, Mo, AgPd, AuPtPd, TiAlFe, TiAlV, CoCrMo, steel, brass and fiber reinforced composites.

12. The dental post system of claim 1 wherein the core is metallic.

13. The dental post system of claim 1 wherein the core includes a first taper that is greater than a second taper of the thermoplastic coating.

14. The dental post system of claim 1 wherein the core includes an inner passage.

15. The dental post system of claim 1 wherein the core includes perforations.

16. The dental post system of claim 1 wherein the core and the thermoplastic coating are bonded by at least one of mechanical and chemical means.

17. The dental post system of claim 1 wherein the outer surface of the core is treated by at least one of mechanical and chemical means.

18. A dental post system comprising:

a rigid core having an outer surface, the rigid core configured for placement in an opening in a tooth root canal;

a less rigid thermoplastic coating coupled to the outer surface; and

a plasticizer applied to the thermoplastic coating causing the thermoplastic coating to adapt to the shape of the opening in the tooth root canal.

19. The dental post system of claim 18 wherein the plasticizer plasticizes the thermoplastic coating but does not plasticize the core.

20. The dental post system of claim 18 further including a resin cement to fill a gap between the dental post system and a tooth dentin.

21. The dental post system of claim 20 wherein the resin cement is adapted to create a bond between the dental post system and the tooth root canal.

22. The dental post system of claim 18 further comprising an increased volume of thermoplastic material at an apical portion of the core.

23. The dental post system of claim 20 wherein the core, the thermoplastic coating, the resin cement and the dentin are bonded to form a monoblock foundation for a tooth restoration.

24. A method of implanting a dental post system comprising:

providing a flexible thermoplastic coating on an inner rigid core;

inserting the rigid core and the coating into an opening in the tooth root canal;

plasticizing the thermoplastic coating; and

adapting the plasticized coating to a shape of the opening in the tooth root canal.

25. The method of claim 24 wherein the rigid core is not plasticized.

26. The method of claim 24 wherein the plasticizing is achieved by any one or more of heating the coating, applying a bonding agent to the coating, and applying a reaction agent to the coating.

27. The method of claim 24 further comprising filling a gap between the coating and the opening in the tooth root canal with a resin cement.

28. The method of claim 27 further comprising bonding the coating, the core, the resin cement and the tooth root canal to form a monoblock foundation for a tooth restoration after the insertion step.

29. The method of claim 24 further comprising applying a restoration to the dental post system.

30. The method of claim 24 further comprising retrieving the dental post system by any one or more of re-plasticizing the coating, dissolving the coating, and unscrewing the core.

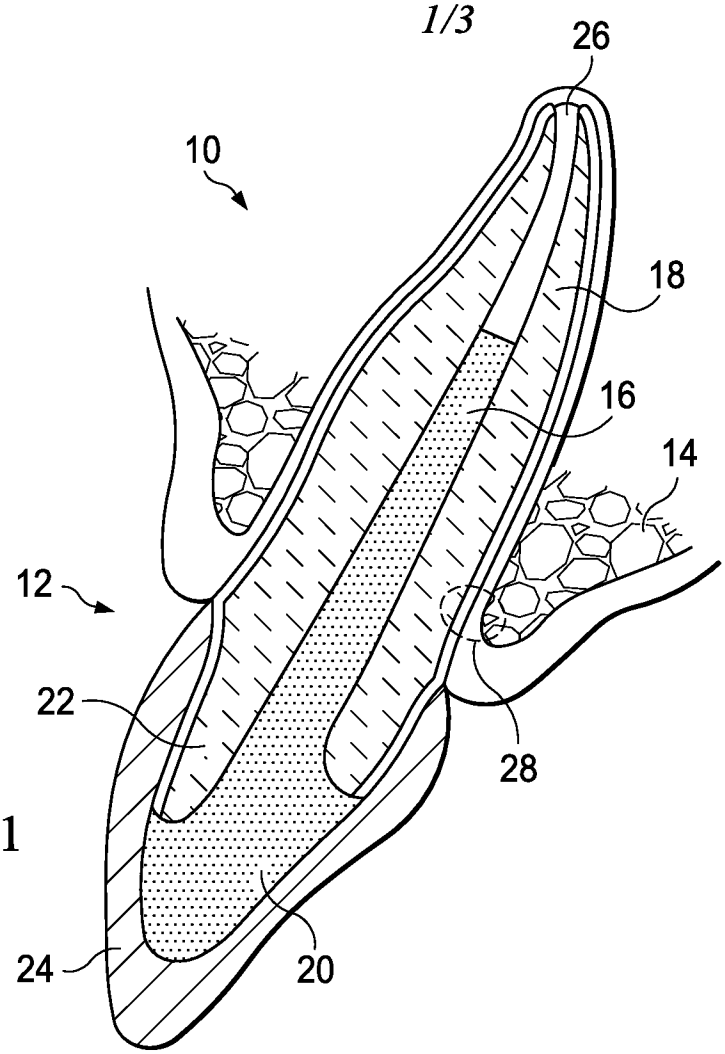

FIG. 1

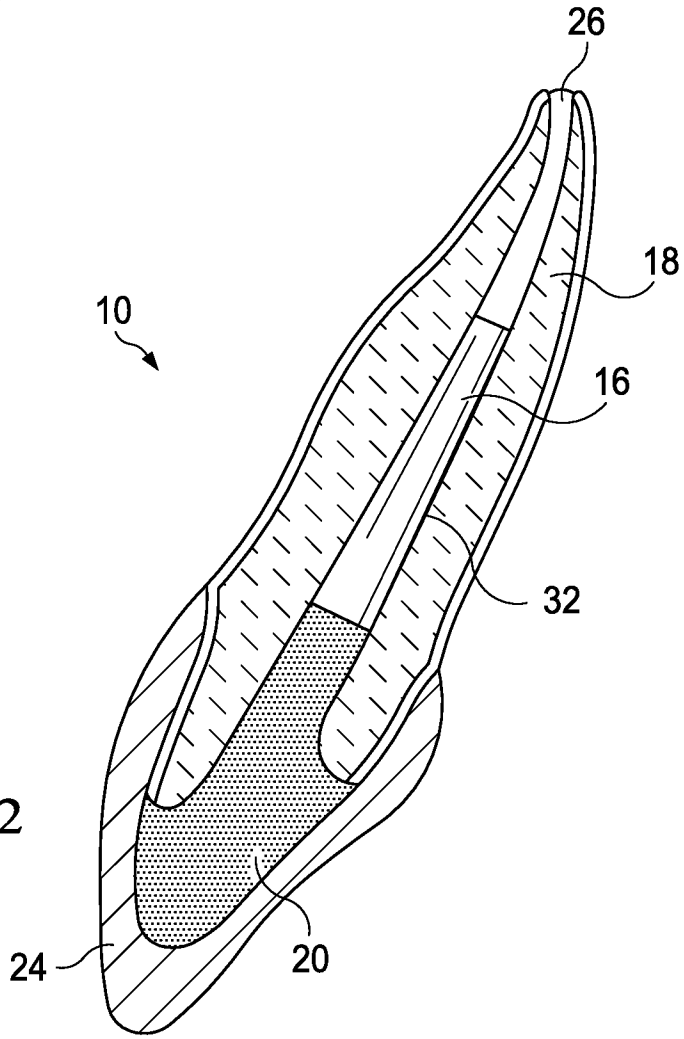

FIG. 2

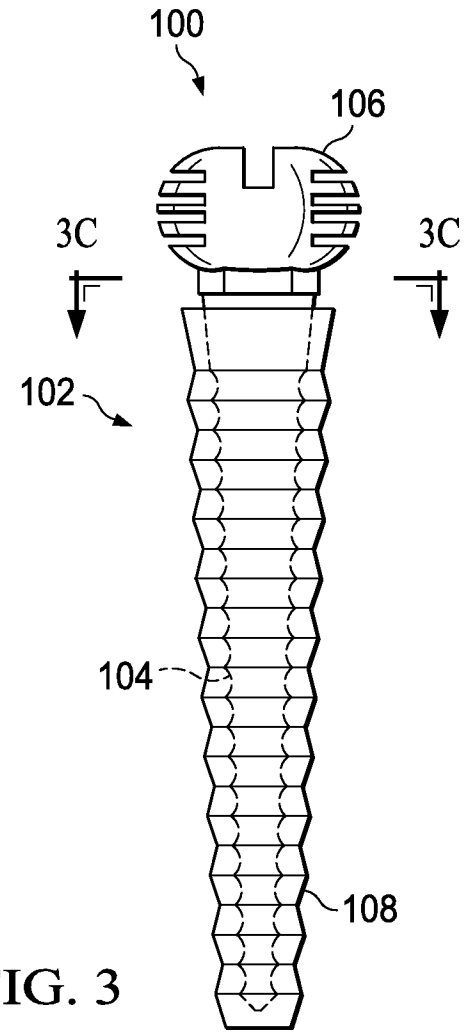

FIG. 3

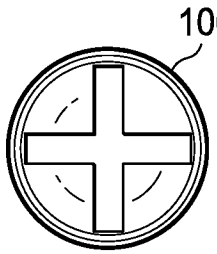

FIG. 3B

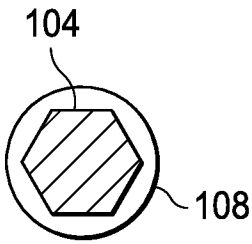

FIG. 3C

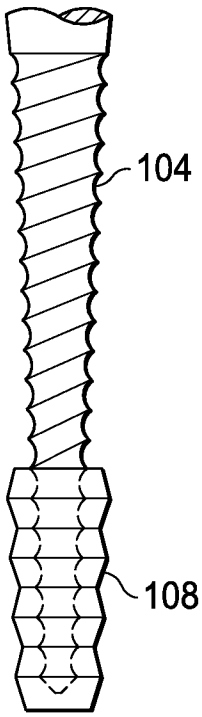

FIG. 3A

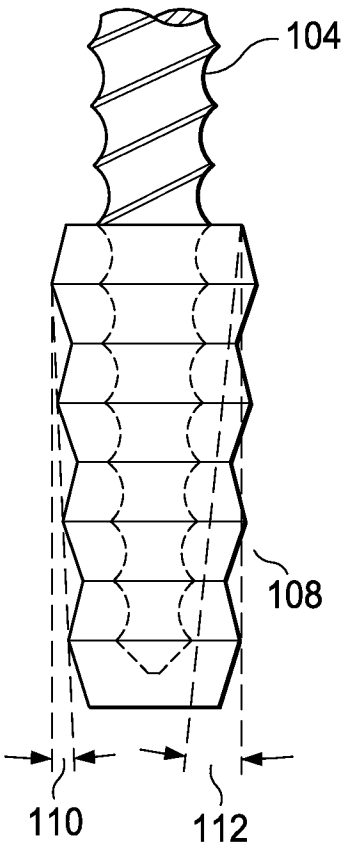

FIG. 3D

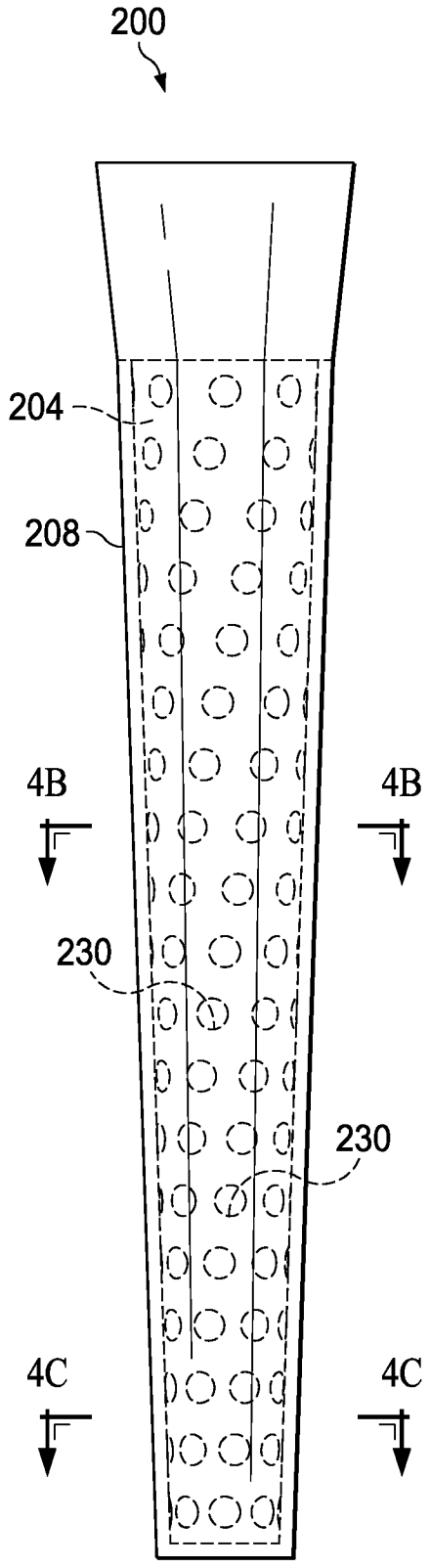

FIG. 4

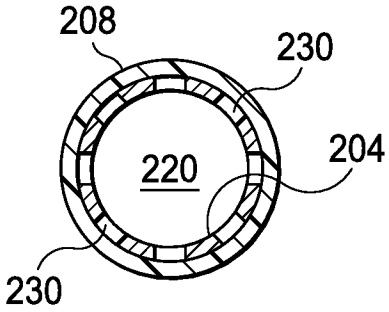

FIG. 4A

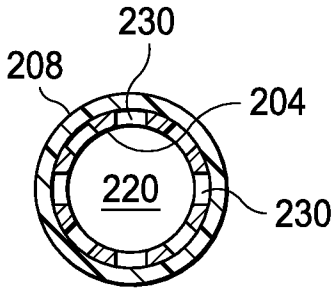

FIG. 4B

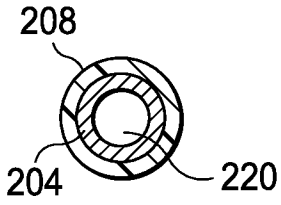

FIG. 4C

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/034057

A. CLASSIFICATION OF SUBJECT MATTER

A61C 5/08(2006.01)i, A61L 27/34(2006.01)i, A61L 27/04(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: A61C 5/08, A61C 5/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models since 1975
Japanese Utility models and applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKIPASS(KIPO internal) & keywords : endodontic obturator, dental post, thermoplastic, filling material, gutta percha

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 7204875 B2 (WEITO JIA and BRUCE ALPERT) 17 April 2007 See Abstract; Figs. 1-3; Col.3-12-Col 11 Line 33	1, 2, 9, 11, 12, 18
X	US 5588835 A (KIMMIE KERT) 31 December 1996 See Abstract; Col. 2 Lines 15-63	1
X	US 6428319 B1 (LARRY A. LOPEZ et al.) 6 August 2002 See Abstract; Figs. 1-5; Col. 3 Line 38-Col.5 Line 61	1, 9, 11, 12
A	US 2006/0154213 A1(KENNETH KOCH and DENNIS BRAVE) 13 July 2006 See Abstract; Figs, 1-9; Claim 1	1-23
A	US 5161973 A (WILLIAM B. JOHNSON) 10 November 1992 See Abstract; Claim 1	1-23

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 MAY 2009 (27.05.2009)	**27 MAY 2009 (27.05.2009)**

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu, Daejeon 302-701, Republic of Korea
Facsimile No. 82-42-472-7140

Authorized officer
OH Seung Jae
Telephone No. 82-42-481-8469

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/034057

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 24-30
because they relate to subject matter not required to be searched by this Authority, namely:

Claim 24 is directed to a method of implanting a dental post system including the steps for inserting the rigid core and the coating into an opening the tooth root canal. This method falls into the category of methods for treatment of the human body by surgery or therapy as well as diagnostic methods. The same reasoning applies to claims 25-30, which are dependent on claim 24 [Article 17(2)(a)(i), Rule 39.1(iv) PCT].

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required addtional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2009/034057

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