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### Tooth model for tooth treatment practice and method for manufacturing the same

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#### Abstract

A tooth model for dental treatment practice is composed of a transparent material and includes a root canal in which a hollow neural tube is formed and a crown formed on top of the root canal, wherein a coating layer is formed inside the neural tube by applying a paint based on an opaque material to an inner surface of the neural tube, so as to show the neural tube formed inside the root canal to the outside.

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## **Background/Summary**

### **CROSS-REFERENCE TO RELATED APPLICATION**

(1) This application claims priority to Korean Patent Application No. 10-2021-0086444, filed on Jul. 1, 2021 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

### **BACKGROUND OF THE DISCLOSURE**

#### **Field of the Disclosure**

(2) The present disclosure relates to a tooth model, and more particularly, to a tooth model for dental treatment practice, with the same morphology and structure as a neural tube in actual teeth so as to be applicable to the practice, as well as a method for manufacturing the same.

#### **Description of the Related Art**

(3) In general, endodontic treatment of a tooth is executed when odontopathogens such as cariogenic bacteria (commonly “tooth cavity”) invade a dental nerve, in particular, the pulp cavity and root canal over the dentin of a coronal part causing pain.

(4) The endodontic treatment may be a type of prosthetic treatment performed such that, when endodontic diagnosis is confirmed in a tooth, a hole is drilled in the tooth body using a dental treatment drill, dental tissue or a blood vessel of the dental nerve is removed using a device for nerve removal, and then the root canal is disinfected, followed by filling the root canal and the hole with alternative materials.

(5) With regard to the endodontic treatment above, since the dental nerve should be completely removed while minimizing damage to the dentin of teeth in order to prevent recurrence of pain and preserve natural teeth as much as possible, dental neuropathic therapies must be thoroughly practiced to master neuropsychiatric techniques.

(6) However, since tooth models even forming a neural structure inside a tooth for practice of such endodontic treatment are not sufficiently present in existing dental educational institutions, dental offices and dentistry seminar, etc., most students may observe the professor who practices the endodontic treatment and then may rely on audiovisual data as a result of recording the above practical treatment on a videotape, otherwise, typically learn such endodontic treatment using a general tooth model, hence causing a problem of deteriorated efficiency in practice.

(7) In other words, since a typical tooth model is manufactured in a form in which only the external shape of a tooth or an oral cavity is formed, it is impossible to directly practice treatment of a neural portion formed in the tooth and, even if the practice is conducted using the above typical tooth model, correct identification of the neural structure and/or direct treatment for removal of dental nerves cannot be performed, and therefore, it is quite difficult to master endodontic treatment.

(8) Therefore, in order to overcome the above problems, the existing tooth model has been manufactured by filling a neural tube formed in a root canal of a tooth with wax, thereby similarly imitating the same.

(9) However, since the existing tooth model has a neural tube filled with wax and a nerve removing

device (endodontic file) is smeared with sticky wax after removal of nerves, the nerves may not be clearly removed.

(10) Further, in the case of conventional tooth models, the morphology of neural tubes formed in the root canal of a tooth is not sufficiently represented, which in turn is not suitable for practice. Further, when seen from the outside, the tooth model entails a problem in that the neural tube is not clearly distinguished.

## RELATED ART LITERATURE

### Patent Literature

(11) (Patent Document 1) Korean Patent Laid-Open Publication No. 10-2019-0143108 (Dec. 30, 2019)

## SUMMARY OF THE DISCLOSURE

(12) Therefore, the present disclosure has been made in view of the above problems, and it is an object of the present disclosure to provide a tooth model for dental treatment practice, in which an opaque material-based paint stains an inner surface of a neural tube formed inside a (dental) root canal of the tooth model composed of a transparent material, so as to show (or expose) the neural tube out of the root canal in the tooth model, as well as a method for manufacturing the same.

(13) It is another object of the present disclosure to provide a tooth model for dental treatment practice, in which the inside of a neural tube has an empty, hollow form, thus enabling easy endodontic treatment practice, as well as a method for manufacturing the same.

(14) It is still another object of the present disclosure to provide a tooth model for dental treatment practice, in which the inner surface of a neural tube is coated with a non-aqueous or insoluble resin-based paint so as to easily confirm whether nerves were sufficiently eliminated after removal thereof, and which can obviously indicate a condition of treatment after irrigation, as well as a method for manufacturing the same.

(15) In accordance with an aspect of the present invention, the above and other objects can be accomplished by the provision of a tooth model for dental treatment practice, which is made of a transparent material, comprising: a root canal including a hollow neural tube formed therein; and a crown formed on top of the root canal, wherein a paint based on an opaque material is applied to an inner surface of the neural tube to form a coating layer so as to show the neural tube formed inside the root canal to the outside.

(16) The paint may be composed of a non-aqueous material or an insoluble material.

(17) The paint may be a resin based synthetic material.

(18) The crown may include a dentin part composed of a soft material, and an enamel part composed of a hard material and formed on top of the dentin part.

(19) The enamel part may be prepared by any one among a milling process, plastic injection molding and 3D printing.

(20) The root canal may be inserted into a mounting groove formed on the dentiform in which the tooth model is mounted, and an intaglio and stepped part ("stepped part") bent down toward an inner bottom of a mounting groove may be formed on an outer surface of the bottom of the root canal.

(21) In accordance with another aspect of the present invention, there is provided a method for manufacturing a tooth model for dental treatment practice, comprising: (a) a first step of preparing a root canal based on a transparent material, in which a hollow neural tube is formed; (b) a second step of introducing a paint based on an opaque material into the neural tube which is formed inside the root canal; (c) a third step of injecting air into the neural tube, to which the paint was introduced, in order to disperse the paint, thereby enabling the paint to be applied to an inner surface of the neural tube; and (d) a fourth step of allowing the paint applied to the inner surface of the neural tube to be cured or hardened over a predetermined time, so as to form a coating layer with a predetermined thickness on the inner surface of the neural tube.

(22) The paint applied to the inner surface of the neural tube in step (d) may be used for surface-

coating of the inner surface by any one process among flame heat treatment, high frequency inductive heat treatment, laser heat treatment, ultraviolet (UV) curing and infrared (IR) curing processes.

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## Description

### BRIEF DESCRIPTION OF THE DRAWINGS

- (1) The above and other objects, features and other advantages of the present disclosure will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:
- (2) FIG. 1 is a cross-sectional view illustrating the tooth model for dental treatment practice according to an embodiment of the present invention;
- (3) FIG. 2 is a photograph illustrating the tooth model for dental treatment practice according to an embodiment of the present invention;
- (4) FIG. 3 is a photograph illustrating the tooth model for dental treatment practice in a state that the tooth model is mounted on a dentiform according to an embodiment of the present invention;
- (5) FIG. 4 is a perspective view and a cross-sectional view illustrating the tooth model for dental treatment practice according to another embodiment of the present invention; and
- (6) FIG. 5 is a flowchart illustrating a method for production of a tooth model for dental treatment practice according to an embodiment of the present invention.

### DETAILED DESCRIPTION OF THE DISCLOSURE

- (7) Hereinafter, preferred embodiments of the tooth model for dental treatment practice according to the present invention will be described in detail with reference to the accompanying drawings.
- (8) FIG. 1 is a cross-sectional view illustrating the tooth model for dental treatment practice according to an embodiment of the present invention; FIG. 2 is a photograph illustrating the tooth model for dental treatment practice according to an embodiment of the present invention; and FIG. 3 is a photograph illustrating the tooth model for dental treatment practice in a state that the tooth model is mounted on a dentiform according to an embodiment of the present invention.
- (9) Referring to FIGS. 1 to 3, the tooth model for dental treatment practice according to a preferred embodiment of the present invention may be a tooth model **100** manufactured with a size and shape similar to actual teeth in order to conduct dental treatment practice.
- (10) Herein, the tooth model **100** of the present invention may include a root canal **110** and a crown **120**.
- (11) The root canal **110** may be composed of a transparent material to show the inside outward. Further, there is provided a neural tube **111** in an empty hollow form inside the root canal **110** of the tooth model **100**.
- (12) In this case, in order to display the neural tube **111** formed inside the root canal **110** of the tooth model **100** to the outside, an opaque material-based paint may be thinly applied to an inner surface of the neural tube **111** to form a coating layer **111a**.
- (13) Herein, the paint used to form the coating layer **111a** is preferably a resin-based synthetic substance consisting of a non-aqueous or insoluble material not easily dissolved in water or alcohol.
- (14) Since the opaque material-based paint stains the inner surface of the neural tube **111** formed inside the root canal **110** of the tooth model which is composed of a transparent material, the neural tube **111** may be seen out of the root canal **110** of the tooth model **100**.
- (15) Further, the neural tube **111** has an empty hollow form, thereby achieving an advantage of easy endodontic treatment practice.
- (16) The crown **120** may be formed on top of the root canal **110**, and may include a dentin part **121** and an enamel part **122** composed of an opaque and rigid material on top of the dentin part **121**.

(17) In this regard, the dentin part **121** is preferably made of a resin-based synthetic substance, may be prepared by means of any one among a milling process, plastic injection-molding and 3D printing, however, the preparation method is not particularly limited to the above listed means.

(18) Further, the enamel part **122** may be made of a specific material such as resin, zirconia and ceramics, etc., and may be prepared by means of any one among a milling process, plastic injection-molding and 3D printing, however, the preparation method is not particularly limited to the above listed means.

(19) Meanwhile, the crown **120** may also be transparent wherein an upper side of the crown may be open.

(20) FIG. **4** is a perspective view and a cross-sectional view illustrating the tooth model for dental treatment practice according to another embodiment of the present invention.

(21) Referring to FIG. **4**, there is further provided a stepped intaglio part (“stepped part”) **112** on an outer surface of the bottom of the root canal **110** in the tooth model **100** for dental treatment practice.

(22) Meanwhile, a dentiform **10**, on which the tooth model **100** of the present invention is mounted, may include a mounting groove **11** into which the root canal **110** is inserted, and a sill (jaw) may be formed on an inner surface of the bottom of the mounting groove **11**.

(23) In other words, since the stepped part **112** bent down toward the inner bottom of the mounting groove **11** formed in the dentiform **10** is formed on an outer surface of the bottom of the root canal **110**, a mounting direction of the tooth model **100** can be marked and the tooth model **100** mounted on the dentiform **10** may be easily fixed when the root canal **110** is inserted into the mounting groove **11**.

(24) In this regard, a binding method between the above-described dentiform **10** and the tooth model **100** is illustrated only as an example, but is not particularly limited to any one binding way. Instead, the tooth model **100** may be bonded to the dentiform **10** by many different methods.

(25) FIG. **5** is a flowchart illustrating a method for production of a tooth model for dental treatment practice according to an embodiment of the present invention.

(26) Referring to FIG. **5**, the method for production of a tooth model for dental treatment practice according to a preferred embodiment of the present invention may firstly include preparing a root canal **110** made of a transparent material, in which a hollow neural tube **111** is formed.

(27) Herein, the root canal **110** may be formed by any one method of a milling process, plastic injection molding and 3D printing.

(28) Then, an opaque material-based paint may be introduced inside the neural tube **111** formed in the root canal **110**.

(29) Then, air is injected into the neural tube **111** containing the paint introduced therein, so as to uniformly distribute and thinly apply the paint to the inner surface of the neural tube **111**.

(30) Lastly, the paint applied to the inner surface of the neural tube **111** may be cured or hardened over a predetermined time to form a coating layer **111a** with a predetermined thickness on the inner surface of the neural tube **111**, thereby completing a tooth model.

(31) In this regard, the paint applied to the inner surface of the neural tube **111** to form a coating layer **111a** with a predetermined thickness on the inner surface of the neural tube **111** may be used for surface-coating of the inner surface of the neural tube **111** by any one among flame heat treatment, high frequency inductive heat treatment, laser heat treatment, ultraviolet (UV) curing and infrared (IR) curing processes, without particular limitation thereto.

(32) Herein, the opaque material-based paint may stain the inner surface of the neural tube **111** formed inside the root canal **110** of the tooth model **100** composed of a transparent material.

(33) The coating layer **111a** stained on the neural tube **111** is formed of a resin-based synthetic material consisting of a non-aqueous or insoluble material not easily dissolved in water or alcohol and, therefore, is not easily removed and may improve durability.

(34) According to the present invention, a paint made of an opaque material stains an inner surface

of a neural tube formed inside a root canal of the tooth model composed of a transparent material, thereby attaining effects of expressing the neural tube out of the root canal in the tooth model.

(35) Further, the tooth model of the present invention has a neural tube having an empty, hollow form, and may be easily used for practice of endodontic treatment.

(36) Further, according to the present invention, a non-aqueous or insoluble resin-based paint is applied to the inner surface of a neural tube so as to easily confirm whether nerves were desirably eliminated after practice of nerve removal, and attain effects of clearly confirming a condition of treatment after irrigation.

(37) Although the present invention has been described in detail with reference to preferred embodiments thereof, those skilled in the art will appreciate that the scope of the present invention is not limited to the embodiments and various modifications and improvements by those skilled in the art using the basic concept of the present invention defined in the appended claims are also within the scope of the present invention.

(38) TABLE-US-00001 [Description of Symbols] 10: Dentiform 11: Mounting groove 100: Tooth model 110: Root canal 111: Neural tube 111a: Coating layer 112: Stepped part 120: Crown 121: Dentin part 122: Enamel part

## Claims

1. A tooth model for dental treatment practice, which is made of a transparent material, comprising: a root canal made of the transparent material and including a hollow neural tube formed in the root canal, wherein the hollow neural tube includes a hollow formed in the hollow neural tube, and the root canal is in a shape of a cylinder extending from an upper part of the root canal to a lower part of the root canal in a downward direction; a crown formed on top of the root canal; and a coating layer formed on an inner surface of the hollow neural tube, wherein a paint based on an opaque material is applied to the inner surface of the neural tube to form the coating layer on the inner surface of the hollow neural tube so as to show the neural tube formed inside the root canal to the outside, wherein the coating layer is formed on the inner surface of the hollow neural tube with a certain thickness such that the coating layer surrounds the hollow in the hollow neural tube, wherein a stepped part is formed at the lower part of the root canal, wherein the stepped part is bent down in the downward direction at the lower part of the root canal such that a size of the lower part of the root canal is smaller than a size of the upper part of the root canal, wherein the stepped part surrounds a portion of the hollow in the hollow neural tube, and wherein the root canal is inserted into a mounting groove formed on a dentiform in which the tooth model is mounted, and wherein the stepped part is bent down toward an inner bottom of the mounting groove.
  2. The tooth model according to claim 1, wherein the paint is composed of a non-aqueous material or an insoluble material.
  3. The tooth model according to claim 2, wherein the paint is a resin based synthetic material.
  4. The tooth model according to claim 1, wherein the crown includes a dentin part composed of a soft material, and an enamel part composed of a hard material and formed on top of the dentin part.
  5. The tooth model according to claim 4, wherein the dentin part and the enamel part are prepared by any one among a milling process, plastic injection molding and 3D printing.
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