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(54) **ORAL RETENTION DEVICE AND PREPARATION METHOD THEREFOR**

(57) Disclosed is an oral retention device and a preparation method therefor. The oral retention device comprises a teeth-fitting component and a tablet-holding component, the teeth-fitting component being connected to the tablet-holding component, wherein the teeth-fitting component is used to bridge teeth in oral cavity and matches with the teeth, and the tablet-holding component can hold at least one medicinal tablet and is used to retain the medicinal tablet in oral cavity. The method for preparing the oral retention device is selected from any one of 3D printing, injection molding, or impression molding. The medicinal tablet can be inserted into the oral retention device of the disclosure to form a drug-device combination, which is fixed on the matching teeth in oral cavity, and in which the medicinal tablet is not easy to drop out in oral cavity, such that the drug can be continuously released within a certain period of time, and the medicinal tablet can be replaced to continuously and stably release the drug.

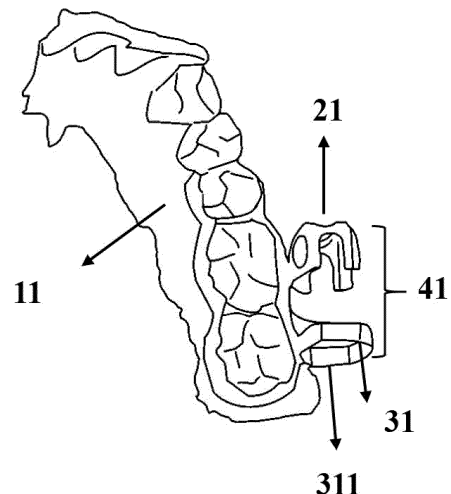


Fig. 1

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Description

Technical Field

[0001] The present disclosure relates to the field of medical devices, and in particular to an oral retention device and a preparation method therefor.

Background

[0002] Many active pharmaceutical ingredients (APIs), including levodopa (LD) or its ester, carbidopa (CD), baclofen, acyclovir, valaciclovir, ganciclovir, metformin, gabapentin, etc., have their absorption window limited at the upper gastrointestinal tract. Incorporation of such APIs into conventional extended release dosages will not only result in reduced bioavailability, but also leads to failure of achieving extended therapeutic coverage. Many techniques have been disclosed in the prior art to prolong the retention time of the active pharmaceutical ingredients in the stomach. These techniques include expansion (US 4,735,804, US 5,002,772, US 6,685,962, etc.), swelling (US 4,434,153, US 5,750,585, US 5,972,389, US 6,120,803, US 6,660,300 B1, US 2007/0196396 A1, US 9,439,851, etc.), floating (US 4,167,558, US 5,232,704, US 6,261,601, etc.), raft-forming (US 4,140,760, US 5,068,109, etc.), subsidence (US 4,193,985, US 4,900,557, etc.), and muco-adhesion (US 6,207,197, US 11/204,106, etc.). The success of the above techniques has been very limited, especially when the oral dosage forms using these techniques are administered at fasting state.

[0003] Therefore, there is a need for a new drug-controlled release system that can provide long-term exposure to these active pharmaceutical ingredients with their absorption window limited at the upper gastrointestinal tract. The oral retention device and these APIs are combined to form a drug-device combination to form an oral retention drug delivery system, which can provide long-term exposure to these APIs with their absorption window limited at the upper gastrointestinal tract.

[0004] At present, there are limited related research on oral retention devices. Patent application US 10/668,274 and patent application CN 1997421 A disclosed an oral drug container based on an electrically controlled drug release mechanism, by which the drug release is electrically controlled, and insertion of medicinal tablets is not involved. Moreover, the drug container and the electric control system claimed in this patent are difficult to implement. There is no example in the patent specification, and it does not explain how to realize, based on the mechanism of electrically controlled drug release, the controlled release of an osmotic pump tablet as a drug storage device to achieve the drug absorption at the upper gastrointestinal tract, thereby achieving the long-term stable blood concentration.

[0005] In addition, CN 1925823 A discloses a dental bracket by which a fluoride pellet is attached to the teeth

to improve the treatment and/or prevention of dental caries. This patent application neither involves the drug absorption at the upper gastrointestinal tract and the long-term stable blood concentration, nor does it involve the way of insertion of medicinal tablets.

[0006] In addition, Chinese Patent Application No. CN 105873631 A discloses an oral retention device that uses an electronic pump or a mechanical pump as an external power for drug delivery, which does not involve the insertion method of medicinal tablets.

[0007] By means of inserting a medicinal tablet from the front to the back (in a direction from the incisors to the molars), the medicinal tablet is easy to slip off from the front of the device (the incisor side), and the patient is likely to suffocate due to accidentally swallowing the dropped medicinal tablet.

Content of the present invention

[0008] In order to solve the technical problem of the defect of low bioavailability due to the short residence time of the active pharmaceutical ingredients in the stomach, the present disclosure provides a new oral retention device that retains a medicinal tablet in oral cavity that is not easy to drop out. Specifically, the present disclosure provides an oral retention device, with a medicinal tablet being inserted in a way from back to front such that, because the back side of the device is close to the throat, and due to blocking by the oral tissues, such as the buccal fat pad tip and the pterygomandibular folds, the medicinal tablet will not easily drop out from the device in oral cavity, which will not cause suffocation due to accidental swallowing.

[0009] A first aspect of the present disclosure provides an oral retention device, comprising a teeth-fitting component and a tablet-holding component. The teeth-fitting component is connected to the tablet-holding component, wherein the teeth-fitting component is used to bridge teeth in oral cavity with the tablet-holding component that can hold at least one medicinal tablet. The oral retention device is used to retain the medicinal tablet in oral cavity.

[0010] In a preferable embodiment, the teeth-fitting component and the tablet-holding component are connected on respective sides; and/or the tablet-holding component has a reticular structure or a non-reticular structure, and the tablet-holding component has cross section in the shape of a circular, elliptical, polygonal, or special-shaped closed ring or open ring structure or a combination thereof. The cross section is a cross section perpendicular to a direction of the long axis of the teeth-fitting component (the direction of the long axis of the teeth-fitting component is substantially equivalent to the horizontal plane formed after matching of the teeth-fitting component and the teeth in oral cavity).

[0011] In a preferable embodiment, the tablet-holding component comprises at least one ring body and at least one retainer, or the tablet-holding component is consti-

tuted by at least one retainer; wherein the ring body has an opening for insertion of a medicinal tablet, and the retainer has a structure for limiting the medicinal tablet in the tablet-holding component.

[0012] In a preferable embodiment, the opening faces the molars in a horizontal direction formed by the molars and the incisors, and is used to enable the medicinal tablet to be inserted from the molars toward the incisors in the horizontal direction; or the opening is provided in a direction perpendicular to the horizontal direction such that the medicinal tablet is inserted down from the above in the direction perpendicular to the horizontal direction; or the opening faces the buccal side in a direction perpendicular to the horizontal direction such that the medicinal tablet is inserted from the buccal side to the lingual side in the direction perpendicular to the horizontal direction. The horizontal direction herein is substantially equivalent to the horizontal direction in which the longest axis of the teeth-fitting component is located when the oral retention device is placed horizontally, and is also substantially equivalent to the horizontal direction in which the oral retention device and the longest axis of the teeth-fitting component are located after the oral retention device matches with the teeth in oral cavity of the subject via the teeth-fitting component.

[0013] Preferably, the form of the medicinal tablet of the present disclosure does not change with time, and the medicinal tablet is an osmotic pump tablet. In a preferable embodiment, the osmotic pump tablet contains an active pharmaceutical ingredient and excipients. The active pharmaceutical ingredient is one of levodopa or its ester, carbidopa, baclofen, acyclovir, valaciclovir, ganciclovir, metformin, and gabapentin, or one or two of levodopa or its ester and carbidopa. The medicinal tablet is a membrane-controlled medicinal tablet, wherein the controlled-release membrane is made of water-insoluble cellulose acetate excipients, and the tablet core is supported by matrix composed of insoluble excipients or the push layer, and after the active pharmaceutical ingredient is completely released from the medicinal tablet in oral cavity, the appearance of the medicinal tablet is still a complete tablet shape.

[0014] Preferably, the ring body is an open ring body or a closed ring body.

[0015] Preferably, the closed ring body is a circular, elliptical, polygonal, or special-shaped closed ring body; and the open ring body is a circular, elliptical, polygonal, or special-shaped open ring body with part thereof missing (non-closed).

[0016] In a preferable embodiment, the retainer is of a circular arc hollow or solid shape, or the retainer is formed by connecting a closed ring body and a semicircular part perpendicular to the closed ring body; and/or the retainer abuts with the ring body, or the retainer and the ring body are arranged at an interval.

[0017] Preferably, the retainer and the ring body are abutted by means of integral molding or are connected together by a connecting structure.

[0018] In a preferable embodiment, the retainer is provided as one retainer that is located on the incisor side in the horizontal direction; and/or the ring body is provided as one ring body that is located on the molar side in the horizontal direction formed by the molars and the incisors.

[0019] Preferably, the teeth-fitting component can match with any one or more teeth in oral cavity, and/or the teeth-fitting component has a length equal to the length of 2-5 teeth.

[0020] Preferably, the teeth are mandibular permanent teeth. Preferably, they are mandibular molars. Most preferably, they are the first molar and the second molar, or are the first molar, the second molar and the second premolar, or are the first molar, the second molar and the third molar, or are the first molar, the second molar, the third molar and the second premolar.

[0021] Preferably, the teeth-fitting component is prepared according to the size and shape of the individual teeth. The teeth-fitting component is wrapped, embedded, fitted, or inserted into the teeth that matches with the teeth-fitting component.

[0022] Preferably, the material of the oral retention device is an oral stable material, which is selected from oral stable metal or thermoplastic elastomer.

[0023] Preferably, the oral stable metal is selected from one of titanium, stainless steel, cobalt-chromium alloy, cobalt-chromium-molybdenum alloy or precious metal for dental use; and the thermoplastic elastomer is selected from copolymers of one or two of polycaprolactone, ethylene-vinyl acetate copolymer, high-density polyethylene, polypropylene, polyacrylate, polyurethane, silicon polymer, polyester, poly(styrene-ethylene-butylene-styrene), poly(styrene-butadiene-styrene), and poly(styreneisoprene-styrene).

[0024] More preferably, the materials of the teeth-fitting component and the tablet-holding component are cobalt-chromium alloy.

[0025] A second aspect of the present disclosure provides a method for preparing the oral retention device according to the first aspect of the present disclosure. The method being selected from any one of 3D printing, injection molding or impression molding.

[0026] The method for preparing the oral retention device according to the first aspect of the present disclosure is 3D printing, comprising the following steps:

(1) adding a saved tablet-holding component plan in design software, assembling the plan with a teeth-fitting component plan to form an integrated oral retention device plan, and exporting a 3D printable file; preferably the design software is 3Shape Dental System;

(2) importing the 3D printable file into a 3D printer, and printing the oral retention device; wherein the 3D printing preferably uses a laser sintering process;

preferably, before the step (1), the following steps are included: (0) designing the tablet-holding component plan according to the data of the size of the medicinal tablet in software, and saving the plan; preferably the software is Solidworks or ZWSOFT; and/or designing the teeth-fitting component plan according to the data of the size of teeth of the subject;

more preferably, the data of the size of the medicinal tablet and/or the data of the teeth of the subject are obtained by means of scanning the tablet and/or the teeth of the subject or the dental model of the subject with a scanner, the dental model is prepared by traditional molding technique, and the scanner is preferably 3 Shape TRIOS® scanner.

[0027] In a specific embodiment, a "3 Shape TRIOS®" intraoral scanner is used to scan the data of size of a medicinal tablet, the data is then imported into the software "SolidWorks", a plan of a tablet-holding component that can load the tablet is designed, and the plan is created and saved as a "standard attachment"; the "3Shape TRIOS®" intraoral scanner is used to scan the teeth of the subject, the data is imported into the software "3 Shape Dental System", and a teeth-fitting component is designed according to the data of teeth; on the software "3 Shape Dental System", the "standard attachment" is added and assembled with the teeth-fitting component to form an integrated oral retention device, and a 3D printable file is exported; and the 3D printable file is imported into the 3D printer, and the oral retention device is printed. The 3D printing preferably uses a laser sintering process.

[0028] The operating principle of the 3D printing is substantially the same as that of an ordinary printer. The 3D printer is internally loaded with different "printing materials", such as metal, ceramic, plastic, and sand, and after the printer is connected to a computer, the "printing material" can be controlled to be stacked layer by layer, and finally the blueprint on the computer is turned into a real object. 3D printing refers to the technical principles of ordinary printers. The layered processing procedure is very similar to inkjet printing. This printing technology is referred to as 3D stereoscopic printing technology. There are many different techniques for printing 3D, which differ in the way they are available and build components at different levels. The 3D printing materials commonly used include nylon, glass fiber, polylactic acid, ABS resin, durable nylon materials, gypsum materials, aluminum materials, metallic titanium, titanium alloy, stainless steel, silver-plated materials, gold-plated materials, cobalt-chromium alloy, cobalt-chromium-molybdenum alloy, or rubber materials, etc. 3D printing is advantageous in that the automated operation can be implemented, the production speed is fast, the design blueprint in the computer can be directly and accurately converted into a physical model, and it is also suitable for small-scale cus-

tom manufacturing.

[0029] In other embodiments, the method for preparing the oral retention device according to the first aspect of the present disclosure is injection molding, comprising the following steps:

(1) preparing a teeth-fitting component model according to a dental model;

(2) preparing a tablet-holding component model according to the size of the medicinal tablet;

(3) obtaining an oral retention device model integrating the teeth-fitting component and the tablet-holding component;

(4) preparing a personalized oral retention device by means of a traditional injection molding process, wherein

preferably, the dental model is prepared by means of the traditional model-taking technology, or prepared by obtaining teeth data of a subject by means of the oral scanning technology and printing; and

more preferably, the materials of the teeth-fitting component model, the tablet-holding component model and the oral retention device model are dental wax, and/or the material of the dental model is gypsum or resin.

[0030] Injection molding is also referred to as injection modeling, and is a method of injection combined with molding, that is, a method in which at a certain temperature, the completely melted material is stirred by a screw, then injected into a mold cavity at high pressure, and cooled and cured to obtain a molded product. The method is suitable for mass production of parts with complex shapes and is one of the important processing methods. The injection molding method is advantageous in that the production speed is fast, the efficiency is high, automated operation can be implemented, the produced articles have a variety of colors, various shapes from simple to complex, various sizes from large to small, and precise size, and the products are easy to upgrade and can be made into parts with complex shapes. Injection molding is suitable for the fields of mass production and molding processing for products with complex shapes.

[0031] In other embodiments, the method for preparing the oral retention device according to the first aspect of the present disclosure is impression molding, comprising:

designing a tablet-holding component according to the size of the medicinal tablet;
preparing the teeth-fitting component from polycaprolactone (PCL) as the material, and

preparing the tablet-holding component from cobalt-chromium alloy as the material;
and assembling the teeth-fitting component and the tablet-holding component into a complete oral retention device.

[0032] In a specific embodiment, at first, a tablet-holding component capable of loading an osmotic pump tablet is prepared by means of a traditional injection molding process; and then a thermoplastic sheet is heated and softened to prepare a teeth-fitting component, and at the same time the softened teeth-fitting component is fitted with the tablet-holding component in an embedded manner and is then cooled to form an integrated oral retention device, which is taken out of oral cavity.

[0033] On the basis of conforming common knowledge in the technical field, the above-mentioned various preferred conditions can be combined in any manner, such that various preferred examples of the present disclosure are obtained.

[0034] Reagents and raw materials used in the present disclosure are all commercially available.

[0035] The positive effect of the present disclosure lies in: providing an oral retention device, with a medicinal tablet being inserted in a direction from the throat to the incisors such that, because the back side of the oral retention device is close to the throat, and due to blocking by the oral mucosal tissues, the medicinal tablet will not drop out in oral cavity. The medicinal tablet is inserted into the oral retention device to form a drug-device combination, which is fixed on the matching teeth in oral cavity, implementing sustained release of the drug within a certain period of time. After being retained for 0-24 hours, the drug-device combination is taken out, replaced with a new medicinal tablet, and re-fixed on the matching teeth in oral cavity, so as to continuously and stably release the drug.

Brief description of the drawings

[0036]

Fig. 1 is an oral retention device with a medicinal tablet being inserted from the back according to an embodiment of the present disclosure, the device being composed of a teeth-fitting component 11 and a tablet-holding component 41, wherein the tablet-holding component 41 is composed of a retainer 21 and a ring body 31, the ring body 31 being provided with an opening 311.

Fig. 2 is an oral retention device with a medicinal tablet being inserted from the front according to an embodiment of the present disclosure, the device being composed of a teeth-fitting component 12 and a tablet-holding component 42, wherein the tablet-holding component 42 is composed of a retainer 22 and a ring body 32, the ring body 32 being provided

with an opening 321.

List of reference numerals:

5 [0037]

11: Teeth-fitting component of back-insertion oral retention device

10 21: Retainer of back-insertion oral retention device

31: Ring body of back-insertion oral retention device

15 311: Opening on ring body of back-insertion oral retention device

41: Tablet-holding component of back-insertion oral retention device

20 12: Teeth-fitting component of front-insertion oral retention device

22: Retainer of front-insertion oral retention device

25 32: Ring body of front-insertion oral retention device

321: Opening on ring body of front-insertion oral retention device

30 42: Tablet-holding component of front-insertion oral retention device

Detailed description of the preferred embodiment

35 **[0038]** The preferred embodiments will be listed below, and the present disclosure will be illustrated more clearly and completely in conjunction with the drawings. It should be noted that unless otherwise specified, the relative arrangement and numerical values of the parts and steps set forth in these embodiments do not limit the scope of the present disclosure.

Example 1 Cobalt-chromium alloy back-insertion oral retention device

45 **[0039]** In the embodiment shown in Fig. 1, the oral retention device with a medicinal tablet being inserted from the back is composed of a teeth-fitting component 11 and a tablet-holding component 41 connected to each other.
50 The teeth-fitting component 11 can be closely attached to the teeth in oral cavity of the subject, and the tablet-holding component 41 is sized to hold at least one medicinal tablet and retain the medicinal tablet in oral cavity.
55 Both the teeth-fitting component 11 and the tablet-holding component 41 are made of cobalt-chromium alloy, and the teeth-fitting component 11 and the tablet-holding component 41 are connected on respective sides. The tablet-holding component comprises a ring body 31 and

a retainer 21 that is located at the end. The ring body 31 is a circular closed ring body with an opening 311 for insertion of a medicinal tablet. The retainer and the ring body are arranged at an interval, and are respectively connected to the teeth-fitting component 11. In another solution, the retainer may be integrally formed with the ring body and then fixed on the teeth-fitting component, and may also be integrally formed with the ring body and the teeth-fitting component. After the oral retention device matches with the teeth in oral cavity of the subject via the teeth-fitting component, the opening 311 opens toward the molars in the horizontal direction formed by the molars and the incisors (the ring body 31 is located on the molar side in the horizontal direction, that is, the position of the ring body 31 is closer to the molars than the position of the retainer 21), and the medicinal tablet is inserted from the molars toward the incisors in the horizontal direction. The retainer is of a circular arc hollow shape, and has a structure configured to limit the medicinal tablet in the tablet-holding component. The teeth-fitting component 11 matches the first molar, the second molar and/or the third molar on the mandible in oral cavity of the subject, and wraps the teeth by means of matching.

[0040] Wearing the oral retention device loaded with a medicinal tablet according to this embodiment in oral cavity, even if the immediate release layer of the drug is quickly dissolved after intensive gargle, the medicinal tablet can be firmly secured and will not slip off the device.

Example 2 Cobalt-chromium alloy front-insertion oral retention device

[0041] In the embodiment shown in Fig. 2, the oral retention device with a medicinal tablet being inserted from the front is composed of a teeth-fitting component 12 and a tablet-holding component 42 connected to each other. The teeth-fitting component 12 can be closely attached to the teeth in oral cavity of the subject, and the tablet-holding component 42 is sized to hold at least one medicinal tablet and retain the medicinal tablet in oral cavity. Both the teeth-fitting component 12 and the tablet-holding component 42 are made of cobalt-chromium alloy, and the teeth-fitting component 12 and the tablet-holding component 42 are connected on respective sides. The tablet-holding component 42 comprises a ring body 32 and a retainer 22 that is located at the end. The ring body 32 is a circular closed ring body with an opening 321 for insertion of a medicinal tablet. The retainer and the ring body are arranged at an interval, and are respectively connected to the teeth-fitting component 11. In another solution, the retainer may be integrally formed with the ring body and then fixed on the teeth-fitting component, and may also be integrally formed with the ring body and the teeth-fitting component. The opening 321 opens toward the incisors in the horizontal direction formed by the molars and the incisors (the ring body 32 is located on the molar side in the horizontal direction formed by the molars and the incisors, that is, the position of the

ring body 32 is closer to the incisors than the position of the retainer 22), and the medicinal tablet is inserted from the incisors toward the molars in the horizontal direction formed by the molars and the incisors. The retainer is of a circular arc hollow shape, and the retainer has a structure configured to limit the medicinal tablet in the tablet-holding component. The teeth-fitting component 11 matches the first molar, the second molar and/or the third molar on the mandible in oral cavity of the subject, and wraps the teeth by means of matching.

[0042] Wearing the oral retention device loaded with a medicinal tablet according to this embodiment in oral cavity, the medicinal tablet may slip off the device during the rapid dissolution of the immediate release layer of the drug after intensive gargle, and may slip off the device during the wearing, but still has a certain use value.

Example 3 Preparation of cobalt-chromium alloy back-insertion oral retention device by means of 3D printing

[0043] The method for preparing the cobalt-chromium alloy back-insertion oral retention device according to this embodiment comprises the following steps:

step 1: obtaining the data of size of the medicinal tablet by scanning with a "3 Shape Dental System" scanner; then, with the software "SolidWorks", designing a tablet-holding component capable of loading the drug part, and creating and saving a "standard attachment"; and every time an oral retention device is designed in the software "3 Shape Dental System", adding the "standard attachment" and assembling same with the teeth-fitting component to form an integrated oral retention device;

step 2: performing an intraoral or dental model scan:

- a. opening scanning software;
- b. creating a new patient file, and creating a new case file;
- c. choosing a research model;
- d. performing scanning on the mandible;
- e. performing scanning on the maxillary;
- f. performing scanning for the occlusal relationship;
- g. post-processing the files to confirm that the scanning data of all molars and premolars are complete and free of defects, and the accurate scanning of occlusion of upper and lower teeth is implemented; and
- h. saving 3OXZ or STL format files.

In this step, a conventional oral scanner in this field, such as 3 Shape Trios oral scanner or a conventional scanner, such as Qscan dental scanner, can be used; therefore a scanning software, such as 3 Shape Trios oral scanner or Qscan dental scanner's own system software can be used.

step 3: designing the device

- a. opening a design software;
- b. creating a new order;
- c. selecting the position of tooth/teeth;
- d. choosing a basal crown design;
- e. importing the oral scanning teeth data (a STL file); designing personalized teeth-fitting component;
- f. adding the "standard attachment" and assembling with the teeth-fitting component to form an integrated oral retention device, in which the opening opens toward the molars in the horizontal direction formed by the molars and the incisors such that the medicinal tablet is located in the horizontal direction formed by the molars and the incisors and can be inserted from the molars toward the incisors; and
- g. after the design is completed, exporting a 3OXZ or STL format file; and

In this step, conventional design software in this field, such as the design software of 3 Shape Dental System, can be used.

step 4: performing 3D printing/in-place polishing/cleaning;

- a. inputting a CAM program;
- b. EOS laser casting;
- c. grinding and polishing, and the device is shown in Figure 1;
- d. cleaning;
- e. inspecting final product.

[0044] As shown in Fig. 1, the cobalt-chromium alloy back-insertion oral retention device prepared according to this embodiment comprises a teeth-fitting component 11 and a tablet-holding component. The teeth-fitting component 11 and the tablet-holding component are connected on respective sides, the teeth-fitting component

can be closely attached to teeth in oral cavity, and the tablet-holding component can hold at least one medicinal tablet and retain the medicinal tablet in oral cavity. The medicinal tablet may be a controlled-release preparation, preferably an osmotic pump tablet. The osmotic pump tablet contains an active pharmaceutical ingredient and excipients. The active pharmaceutical ingredient includes levodopa or its ester, carbidopa, baclofen, acyclovir, valaciclovir, ganciclovir, metformin, and gabapentin, or one or two of levodopa or its ester and carbidopa. The tablet-holding component has a cross section in the shape of a circular closed loop. The tablet-holding component may have a reticular structure or a non-reticular structure. The tablet-holding component comprises at least one ring body 31 and at least one retainer 21 that is located at the end, and the ring body 31 forms an opening 311 for insertion of a medicinal tablet. The retainer is of a circular arc hollow shape. The opening faces the molars in the horizontal direction formed by the molars and the incisors, and the medicinal tablet is inserted from the molars toward the incisors in the horizontal direction.

Example 4 Preparation of cobalt-chromium alloy oral retention device by means of injection molding

[0045] At first, a dental gypsum model of a patient/volunteer is prepared by means of the traditional model-taking technology; then, by means of a traditional manual process, with dental wax as the material, a dental wax model is manually prepared based on the gypsum model; and finally, with cobalt-chromium porcelain alloy as the material, the oral retention device is prepared by means of a traditional injection molding process.

Example 5 Cobalt-chromium alloy front-insertion oral retention device prepared by means of 3D printing

[0046] The oral retention device as shown in Fig. 2 is prepared by the same method as Example 3, only different in the f in step 3, the positions of the ring body and the retainer of the tablet-holding component are opposite to those in Example 3. The ring body 32 of the tablet-holding component 42 forms an opening 321 for insertion of a medicinal tablet, the opening opens toward the incisors in the horizontal direction formed by the molars and the incisors, and the medicinal tablet is inserted from the incisors to the molars in the horizontal direction. The medicinal tablet may be a controlled-release preparation, preferably an osmotic pump tablet.

Claims

1. An oral retention device, comprising a teeth-fitting component and a tablet-holding component, with the teeth-fitting component connected to the tablet-holding component, wherein the teeth-fitting component is used bridge the teeth in oral cavity and the tablet-

holding component can hold at least one medicinal tablet and is used to retain the medicinal tablet in oral cavity.

2. The oral retention device as defined in claim 1, wherein the teeth-fitting component and the tablet-holding component are connected on respective sides; and/or the tablet-holding component has a reticular structure or a non-reticular structure, and the tablet-holding component has a cross section in the shape of a circular, elliptical, polygonal, or special-shaped closed ring or open ring structure;

preferably, the tablet-holding component comprises at least one ring body and at least one retainer, or the tablet-holding component is constituted by at least one retainer; wherein the ring body has an opening for insertion of a medicinal tablet, and the retainer has a structure for limiting the medicinal tablet in the tablet-holding component;

more preferably, the opening faces the molars in a horizontal direction formed by the molars and the incisors, and is used to enable the medicinal tablet to be inserted from the molars toward the incisors in the horizontal direction; or the opening is provided in a direction perpendicular to the horizontal direction such that the medicinal tablet is inserted down from the above in the direction perpendicular to the horizontal direction; or the opening faces the buccal side in a direction perpendicular to the horizontal direction such that the medicinal tablet is inserted from the buccal side to the lingual side in the direction perpendicular to the horizontal direction.

3. The oral retention device as defined in claim 2, wherein the medicinal tablet is an osmotic pump tablet; and preferably, the osmotic pump tablet contains an active pharmaceutical ingredient and excipients, the active pharmaceutical ingredient is one or more of levodopa or its ester, carbidopa, baclofen, acyclovir, valaciclovir, ganciclovir, metformin, and gabapentin, or one or two of levodopa or its ester and carbidopa.
4. The oral retention device as defined in claim 2, wherein the ring body is an open ring body or a closed ring body; and preferably, the ring body is a circular, elliptical, polygonal, or special-shaped closed ring body or open ring body.
5. The oral retention device as defined in claim 2, wherein the retainer is of a circular arc hollow or solid shape, or the retainer is formed by connecting a closed ring body and a semicircular part perpendicular to the closed ring body; and/or the retainer abuts

with the ring body, or the retainer and the ring body are arranged at an interval; and preferably, the retainer and the ring body are abutted by means of integral molding or are connected together by a connecting structure.

6. The oral retention device as defined in claim 2, wherein the retainer is provided as one retainer that is located on the incisor side in the horizontal direction formed by the molars and the incisors; and/or the ring body is provided as one ring body that is located on the molar side in the horizontal direction formed by the molars and the incisors.

7. The oral retention device as defined in claim 1, wherein the teeth-fitting component can match with any one or more teeth in oral cavity, and/or the teeth-fitting component has a length equal to the length of 2-5 teeth; and preferably, the teeth are mandibular permanent teeth, preferably mandibular molars, and more preferably the first molar and the second molar, or the first molar, the second molar and the second premolar, or the first molar, the second molar and the third molar, or the first molar, the second molar, the third molar and the second premolar on the mandible.

8. The oral retention device as defined in claim 1, wherein the teeth-fitting component is wrapped, embedded, fitted, or inserted into the teeth that matches with the teeth-fitting component.

9. The oral retention device as defined in any one of claims 1-8, wherein the material of the oral retention device is an oral stable material, which is selected from oral stable metal or thermoplastic elastomer;

preferably, the oral stable metal is one of titanium, stainless steel, cobalt-chromium alloy, cobalt-chromium-molybdenum alloy or precious metal for dental use, and the thermoplastic elastomer is one or two copolymers selected from polycaprolactone, ethylene-vinyl acetate copolymer, high-density polyethylene, polypropylene, polyacrylate, polyurethane, silicon polymer, polyester, poly(styrene-ethylene-butylene-styrene), poly(styrene-butadiene-styrene), and poly(styrene-isoprene-styrene); and more preferably, the materials of the teeth-fitting component and the tablet-holding component are cobalt-chromium alloy.

10. A method for preparing the oral retention device as defined in any one of claims 1-9, the method being selected from any one of 3D printing, injection molding or impression molding;

wherein the 3D printing comprises the following

steps:

- (1) adding a saved tablet-holding component model, assembling the model with a teeth-fitting component model to form an integrated oral retention device model, and exporting a 3D printable file; wherein the design software is preferably 3 Shape Dental System, 5
- (2) importing the 3D printable file into a 3D printer, and printing the oral retention device; wherein the 3D printing preferably uses a laser sintering process; 10

preferably, before the step (1), the following steps are included: (0) in preferable software SolidWorks or ZWSOFT, designing the tablet-holding component model according to the size data of the medicinal tablet, and saving the model; and/or in the design software 3 Shape Dental System, designing the teeth-fitting component model according to the size data of teeth of the subject; and 15

more preferably, obtaining the size data of the medicinal tablet and/or the dental data of the subject by means of scanning with a scanner, and the dental model is prepared by traditional molding technique, which is preferably a 3Shape TRIOS® scanner; 20

wherein, the injection molding comprises the following steps: 25

- (1) preparing a teeth-fitting component model according to a dental model; 30
- (2) preparing a tablet-holding component model according to the size of the medicinal tablet; 35
- (3) obtaining an oral retention device model integrating the teeth-fitting component and the tablet-holding component; and 40
- (4) preparing a personalized oral retention device by means of a traditional injection molding process, wherein 45

preferably, the dental model is prepared by traditional molding technology, or prepared by obtaining teeth data of a subject via oral scanning technology and printing; and 50

more preferably, the materials of the teeth-fitting component model, the tablet-holding component model and the oral retention device model are dental wax, and/or the material of the dental model is gypsum or resin. 55

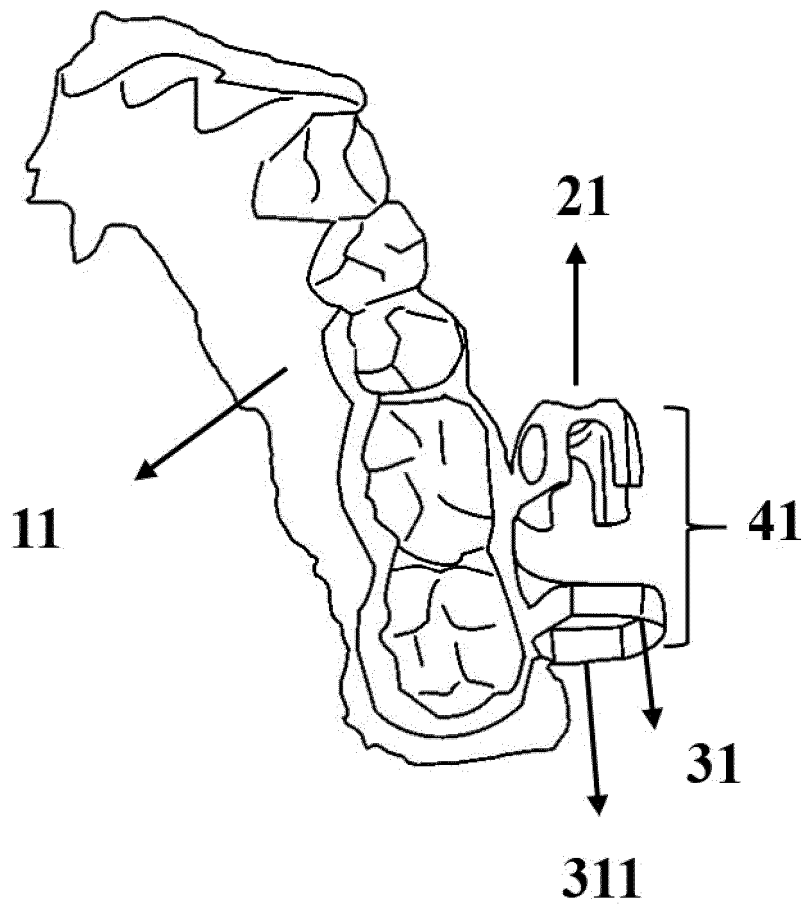


Fig. 1

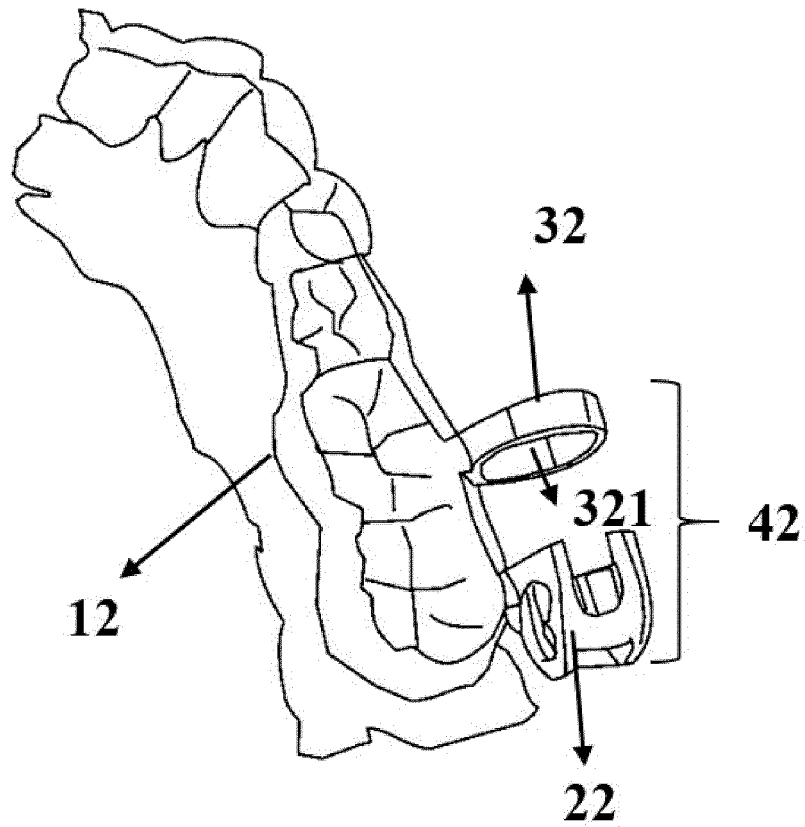


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/119120

5	A. CLASSIFICATION OF SUBJECT MATTER A61J 7/00(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC		
10	B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) A61J Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
15	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNABS; CNTXT; CNKI; VEN; USTXT; WOTXT; EPTXT; 药, 固定, 保持, 口腔, 牙齿, 释放, 滞留, 泵, 渗透, 模型, 印模, 3D, release, absorption, teeth, tooth, dental, medicine, fix, drugs		
20	C. DOCUMENTS CONSIDERED TO BE RELEVANT		
25	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
30	PX	CN 212973560 U (SHANGHAI HANDU PHARMACEUTICAL TECHNOLOGY CO., LTD.) 16 April 2021 (2021-04-16) description paragraphs [0008]-[0081], figures 1, 2	1-10
35	X	WO 2019223753 A1 (SHANGHAI WD PHARMACEUTICAL CO LTD) 28 November 2019 (2019-11-28) description page 3 paragraph 3- page 39 paragraph 6, figures 1-21	1-10
40	X	KR 101424763 B1 (HYUN KI BONG) 01 August 2014 (2014-08-01) description, paragraphs [0008]-[0061], and figures 1-20	1-10
45	A	US 2015238292 A1 (INNOVATIVE PRODUCTS INC) 27 August 2015 (2015-08-27) entire document	1-10
50	A	CN 1997421 A (WOLFF ANDY et al.) 11 July 2007 (2007-07-11) entire document	1-10
55	<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
55	* 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 another 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
55	Date of the actual completion of the international search 23 October 2021		Date of mailing of the international search report 17 November 2021
55	Name and mailing address of the ISA/CN China National Intellectual Property Administration (ISA/ CN) No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088 China Facsimile No. (86-10)62019451		Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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PCT/CN2021/119120

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				WO	2004069076	A3	30 November 2006
				EP	1648327	A2	26 April 2006
				EP	1648327	A4	13 November 2013
				US	2004158194	A1	12 August 2004

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