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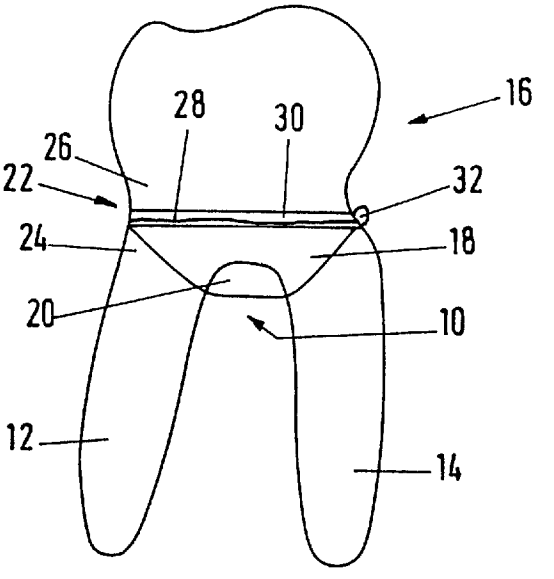
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(54) **DISPOSITIF PERMETTANT DE TRAITER UNE CAVITE OSSEUSE**

(54) **APPARATUS FOR TREATING A BONE RECESS**



(57) L'invention concerne un dispositif permettant de traiter une cavité osseuse (20) formée dans la zone de jonction (10) des deux branches d'une fourche dentaire, qui comprend un dispositif plan de recouvrement comportant une membrane de recouvrement (18) à action cellulo-occlusive et servant à recouvrir temporairement la cavité osseuse (20) vis-à-vis du tissu mou environnant, ledit dispositif pouvant être plié vers le haut en direction de l'extrémité distale de la dent, après son introduction entre les branches (12, 14) de la fourche. Après avoir été appliqué sur les deux surfaces dentaires sensiblement parallèles à la ligne de jonction

(57) A device for treating a bone recess (20) formed in the junction region (10) of the two branches (12, 14) of a tooth bifurcation, with a flat covering device having a cell-occlusive covering membrane (18) to provide a temporary covering for the bone recess (20) against the surrounding soft tissue, which can be bent upwards towards the distal end of the tooth after being passed between the branches (12, 14) of the bifurcation and secured to the tooth (16) in the boundary region (22) between the tooth cement (21) and tooth enamel (26) after laying on the two tooth surfaces substantially parallel to the connecting line between the central axes of

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des axes médians longitudinaux des deux branches, ledit dispositif peut être fixé à la dent (16), dans la zone d'interface (22) entre le cément (24) et l'émail (26) de la dent. Sur ses deux bords transversaux distaux correspondant à la zone d'interface (22) entre le cément (24) et l'émail (26) de la dent, le dispositif de recouvrement (18) comporte un élément auxiliaire de montage. Ce dispositif se caractérise en ce que l'auxiliaire de montage comporte un dispositif de fixation (28, 30, 34) qui permet de monter, par liaison de forme et/ou de force, le dispositif de recouvrement (18) sur la dent (16).

the two branches. The covering device (18) has a securing aid at its two distal transverse edges corresponding to the boundary region (22) between tooth cement (24) and tooth enamel (26). This device is characterized in that the securing aid has a securing device (28, 30, 34) to secure the covering device (18) interlockingly and/or by frictional engagement to the tooth (16).

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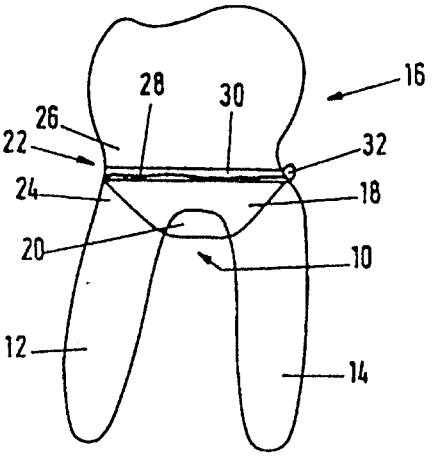
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(54) Title: DEVICE FOR TREATING A BONE RECESS

(54) Bezeichnung: VORRICHTUNG ZUM BEHANDELN EINER KNOCHENAUSNEHMUNG

(57) Abstract

A device for treating a bone recess (20) formed in the junction region (10) of the two branches (12, 14) of a tooth bifurcation, with a flat covering device having a cell-occlusive covering membrane (18) to provide a temporary covering for the bone recess (20) against the surrounding soft tissue, which can be bent upwards towards the distal end of the tooth after being passed between the branches (12, 14) of the bifurcation and secured to the tooth (16) in the boundary region (22) between the tooth cement (21) and tooth enamel (26) after laying on the two tooth surfaces substantially parallel to the connecting line between the central axes of the two branches. The covering device (18) has a securing aid at its two distal transverse edges corresponding to the boundary region (22) between tooth cement (24) and tooth enamel (26). This device is characterized in that the securing aid has a securing device (28, 30, 34) to secure the covering device (18) interlockingly and/or by frictional engagement to the tooth (16).



(57) Zusammenfassung

Vorrichtung zum Behandeln einer im Verbindungsbereich (10) der beiden Schenkel (12, 14) einer Zahnbifurkation gebildeten Knochenausnehmung (20), mit einer eine zellokklusiv wirkende Abdeckmembran (18) aufweisenden flächigen Abdeckeinrichtung zum vorübergehenden Abdecken der Knochenausnehmung (20) gegenüber dem umgebenden Weichgewebe, welche nach Hindurchführen zwischen den Schenkeln (12, 14) der Bifurkation in Richtung auf das distale Zahnende hochbiegbar und nach Anlegen an die beiden zur Verbindungslinie der Längsmittelachsen der beiden Schenkel (12, 14) im wesentlichen parallelen Zahnflächen im Grenzbereich (22) zwischen Zahnzement (24) und Zahnschmelz (26) am Zahn (16) befestigbar ist, wobei die Abdeckeinrichtung (18) an ihren beiden dem Grenzbereich (22) zwischen Zahnzement (24) und Zahnschmelz (26) entsprechenden distalen Querrändern eine Festlegehilfe aufweist, dadurch gekennzeichnet, dass die Festlegehilfe eine Befestigungseinrichtung (28, 30, 34) zum form- und/oder kraftschlüssigen Festlegen der Abdeckeinrichtung (18) am Zahn (16) aufweist.

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Apparatus for treating a bone recess

The invention relates to an apparatus for treating a bone recess formed in the region of the connection of the two limbs of a tooth bifurcation, with a flat covering means, having a front side and a back side, that comprises a covering membrane that operates in cell-occlusive fashion, for the temporary covering of the bone recess against the surrounding soft tissue, which covering means can be fastened to the tooth in the boundary region between the dental cement and the dental enamel, whereby the covering means comprises an affixing aid at its two distal transverse edges corresponding to the boundary region between the dental cement and the dental enamel, said affixing aid having a fastening means for the positive and/or non-positive affixing of the covering means to the tooth.

It is known that the refilling of bone recesses with bone material can be simplified considerably by temporarily covering the relevant bone recess against the surrounding soft tissue with a covering means, e.g. a covering membrane or foil made of bioresorbable material, in a reliably mechanical and essentially liquid-tight fashion, so as to enable the exclusively osseous growing through of the bone recess. Examples of corresponding apparatuses are described in DE-OS 44 14 675, DE-OS 44 18 159, DE-OS 43 02 708 and DE-OS 43 02 709.

Furthermore, WO-A-92/10218 relates to an implantable bioabsorbable apparatus that serves to cover a tissue flaw. In the disclosure of this document, special attention is given to the provision of a particularly advantageous laminar construction of the covering means.

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Likewise, WO-A-90/11730 is also concerned with covering apparatuses for bone flaws, and here as well a specific layer construction is proposed.

A separating membrane is also specified in DE-U-94 16 013. Besides the selection of material, reference is also made in the disclosure to the shaping of the membrane. For this shaping, in the case discussed it is crucial that large regions of the jaw are to be covered with the membrane.

WO-A-95/09583 presents an implant that is characterized in that there are pores located in its surface that comprise particularly advantageous shapings in its edge region. By means of this construction, the implant is supposed to be given better support at its region of use.

Apparatuses of this class are described for example in Implantologie 1995, 1, pp. 21-37, in which the description relates generally to the treatment of bone recesses in teeth, without an express discussion of the problematic of the treatment of bifurcations; such apparatuses create difficulties in particular when they are used for treating bone recesses in the root area of bifurcated teeth, insofar as a reliable seating of the covering membrane on the "inner limb" of the bifurcation cannot be unproblematically ensured, whereby, especially after a refolding upwards of the gingiva at the bifurcation, the covering membrane often slips out of place, causing a partial opening of the bone recesses. In this way, soft tissue can enter into the bone recess, so that this recess can no longer unproblematically be grown through with osseous material. Up to now, a covering membrane of this sort, with an essentially rectangular cross-section, has been used in bifurcation treatments in such a way that the upper transverse edges of the covering membrane are held there by means of a thread wrapped around the tooth or the like,

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without hereby reliably preventing a penetration of soft tissue into the bone recess in the region of connection of the limbs of the bifurcation.

The underlying object of the invention is to create an apparatus of this class that ensures the unproblematic exclusively osseous filling of the bone recess in the region of connection of the limbs of a tooth bifurcation.

According to the invention, this object is achieved in that the covering means comprises a narrowed region between the transverse edges, so that after being led between the limbs of the bifurcation it can be folded up in the direction towards the distal tooth end, and can be fastened using the fastening means after being seated on the two tooth surfaces that are essentially parallel to the line of connection of the longitudinal midaxes of the two limbs.

It can thereby be provided that the fastening means comprises a cover for the guiding through of a ligature thread that is fixedly connected with the covering means at at least one position.

The invention also proposes that the covering means comprises an interlocking projecting part on at least one of its transverse edges, to be brought to engage in a recess that is present or can be produced in the boundary region between the dental cement and the dental enamel.

According to the invention, it can also be provided that the interlocking projecting part has the form of a shoulder that projects, essentially in an L-shape, from the plane of the covering means in the direction towards the front side.

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A further embodiment of the invention provides that the interlocking projecting part has the form of a hook-in nose that projects from the plane of the covering means in the direction towards the front side.

It can thereby be provided that the interlocking projecting part has the form of a thickening of the material of the covering membrane.

In addition, the invention provides that the thickening is fashioned in the form of a ledge.

According to the invention, it is hereby provided that the fastening means is fashioned in one piece with the covering membrane.

It can thereby be provided that the fastening means comprises an adhesive strip or the like on at least one of the transverse edges of the covering means.

The invention also proposes that at least the covering membrane of the covering means is made of bioresorbable material.

A further embodiment of the invention proposes that the covering means is made entirely of bioresorbable material.

It is thereby provided according to the invention that the covering means is fashioned so as to be expandable and compressible.

According to the invention, it is also provided that the covering means is of shrinkable construction, at least in the region of the transverse edges.

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An additional embodiment of the invention provides that the covering means is of chemically shrinkable construction, at least in the region of the transverse edges.

It can thereby be provided that the covering means is of thermally shrinkable construction, at least in the region of the transverse edges.

In addition, the invention provides that the covering means is preformed in bulged fashion.

A further embodiment of the invention provides that the covering means comprises a reinforcement in its narrowed region.

The invention also provides that the reinforcement consists of a reinforcement mesh, such as titanium mesh or the like.

In addition, it is proposed according to the invention that the front side and/or the back side of the covering membrane (each) comprise(s) a retention support apparatus, for the improvement of the retention of the soft tissue or, respectively, of the (respective) collagen structure(s) on the covering membrane.

The invention also provides that the retention support apparatus(es) (respectively) comprise(s) at least one mechanical retention aid.

In addition, the invention provides that the mechanically acting retention aid(s) is/are constructed at least partially for positive clasping through soft tissue and/or collagen structure(s).

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In addition, it is proposed according to the invention that the mechanical retention aid(s) is/are formed at least partially by means of projections and/or recesses of the covering membrane of the covering means.

The invention also provides that the mechanical retention aid(s) is/are formed at least partially by means of surface irregularities of the covering membrane of the covering means.

In addition, it is provided according to the invention that the mechanical retention aids are formed at least partially by means of a woven-type and/or knit-type surface structure of the front side or, respectively, of the back side of the covering membrane of the covering means.

In addition, the invention provides that the retention support apparatuses is/are formed at least partially by corresponding selection of the chemical composition and/or the morphological structure of the material of the covering membrane in the material of the front side or, respectively, of the back side of the covering membrane.

It is advantageous if the inventive apparatus comprises at least two layers of differing structure and/or composition, whereby at least one of the external layers comprises the retention support apparatus(es).

Furthermore, open micropores can be provided in the external side(s).

[... : lack of continuity from page 6 to page 6a in German amended pages:]
whereby the interaction is of a chemical and/or physical nature.

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The invention is based on the surprising finding that even bone recesses in the root area of bifurcated teeth can successfully be grown through with osseous material with no problems, through the use of a covering means or, respectively, covering membrane that can be reliably seated on the tooth and can also be fixed in this position.

In addition, or in place of this, chemical, i.e. molecularly acting, docking aids can also be provided that are formed if warranted by means of a corresponding specific "special layer" of the covering membrane, which faces e.g. the connective tissue. By means of such a multilayer construction of the covering membrane, it is possible to optimize the layer facing the connective tissue, or, respectively, the location of the bone flaw, in such a way that a particularly good connection with the growing tissue or, respectively, with the

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corresponding collagen structures is ensured. The base layer can thereby be constructed in such a way that a particularly good cell-occlusive and/or mechanically supporting effect results.

In any case, it is thereby essential that by means of corresponding construction, e.g. also structuring, of the surface facing the soft tissue or, respectively, the bone tissue, the growing of collagen structures from the connective tissue is enabled.

Further features and advantages of the invention result from the following specification, in which exemplary embodiments are explained in detail on the basis of the schematic drawing.

Fig. 1 shows a first exemplary embodiment of an apparatus according to the invention, seated on a bifurcated tooth, in a side view perpendicular to the connection line of the longitudinal midaxis of the two limbs of the bifurcation;

Fig. 2 shows the exemplary embodiment of Fig. 2 in a side view rotated by 90° in relation to Fig. 1;

Fig. 3 shows a detail of a further exemplary embodiment of the apparatus according to the invention, in an orientation corresponding to Fig. 2, but in section;

Fig. 4 shows a detail of the exemplary embodiment of Fig. 1 and 2 in a top view, in a state not seated on the tooth;

Fig. 5 shows a detail of the exemplary embodiment according to Fig. 4, in section perpendicular to the plane of

the flat covering means, in the region of its transverse edge;

Fig. 6 shows, in a representation corresponding to Fig. 5, a detail of a modified exemplary embodiment of an apparatus according to the invention;

Fig. 7 shows the exemplary embodiment of Fig. 6 in a top view of the plane of the covering means;

Fig. 8 shows, in a representation corresponding to Fig. 7, a modified exemplary embodiment of an apparatus according to the invention;

Fig. 9 shows a further exemplary embodiment of a covering membrane of an apparatus according to the invention, in a section perpendicular to the plane of the membrane;

Fig. 10 shows, in a representation corresponding to Fig. 9, a further exemplary embodiment of a covering membrane of an apparatus according to the invention; and

Fig. 11 shows, in a representation corresponding to Fig. 10, a further exemplary embodiment of a covering membrane of an apparatus according to the invention.

As can be seen in Fig. 1, in a connection region 10 between two limbs 12, 14 of a bifurcated root of a tooth 16, a covering means consisting of a covering membrane 18 made of bioresorbable material such as polylactide or the like is arranged there for the covering of a bone recess 20, in such a way that the covering membrane 18 [...] seated snugly in a border region 22 between the dental cement 24 and the dental

enamel 26 by means of a ligature thread 28 that is drawn into a ligature overcoat **[sic]** 30 on the transverse edge(s) drawn in at the top in Figure 1 (the upper transverse edge, lying behind the plane of the drawing, is not shown in the drawing), whereby, as can be seen in Fig. 1, the border region 22 forms a constriction, which can also be created or deepened by the surgeon as warranted. By means of the covering membrane 20, the bone recess is protected against penetration by soft tissue coming to lie against the covering membrane 20 at the bottom of Fig. 1, so that, after a corresponding damaging of the bone forming the limbs 12, 14, which together form the root of the tooth, the bone recess 20 can be grown through with osseous material in undisturbed fashion in the connection region 10, as is generally known from the technique of the use of covering membranes for the treatment of bone recesses. The covering membrane 18 consists of material that is preformed with a bulge and that is in addition bielastic, so that, given a corresponding cutting, it can be seated as if "in the manner of swim trunks" both on the "limb inner surfaces" of the two limbs 12, 14 and on the outer surfaces thereof, and can be fixed reliably and without slippage to the tooth 16 by means of the ligature thread 28, which after the "covering" is introduced into the ligature overcoat **[sic]** 30.

Fig. 2 shows the individual elements of the apparatus according to the exemplary embodiment of Fig. 1, in an arrangement rotated by 90°, whereby a knot 32 can also be seen here by means of which the ends of the ligature thread was seated with one another by the surgeon **[sic]**, with tightening of the covering membrane 18 in the region of the ligature overcoat **[sic]** 30 on the outer surface of the tooth 16.

Fig. 4 shows an enlarged representation of the ligature overcoat **[sic]** 30 and the ligature thread 28 of an exemplary embodiment corresponding to Fig. 1 and 2.

Fig. 5 shows an enlarged representation of a section through the ligature overcoat **[sic]** 30 of the exemplary embodiment of Fig. 4.

In the exemplary embodiment of Figs. 1 to 5, the apparatus is used as follows: first, the surgeon folds the gingiva, from the plane of the drawing of Fig. 1 or, respectively, from the plane parallel thereto on the back side of the tooth 16, down far enough that the bone recess 20, which can for example be caused by an inflammation of the root, is exposed on both sides. Next, the covering membrane, which is preformed essentially in a rectangular shape or, respectively, in a bifurcated shape, is drawn through the cavity, is thereupon folded up into the border region 22 between the dental cement 24 and the dental enamel 26, and then, by means of the drawing of the ligature thread 28 into the ligature overcoat **[sic]** 30 of the two transverse edges, is provided with the affixing means hereby formed. Subsequently, the ligature thread 28 is drawn tight and is knotted by means of the knot 32. The covering membrane thereupon seals the bone recess 20 against the soft tissue without slippage. Subsequently, the gingiva is closed again by the surgeon.

After the periosteum there has been correspondingly damaged, e.g. bored through, so that a bleeding in from the bone material of the tooth is possible, the bone recess now grows out with osseous material in about 4 to 6 months. Since the covering membrane 18 is made of bioresorbable material, it can remain in the body, as can the ligature thread 30, which is also made of bioresorbable material.

In the exemplary embodiment of Fig. 3, the covering membrane 18 comprises a ledge-type thickening 34 on its upper transverse edge, which thickening engages positively in the naturally existing constriction between the dental cement 24 and the dental enamel 26 in the border region 22, and in this way prevents the covering membrane 18 from sliding down. An exemplary embodiment of a thickening of this sort is reproduced in an enlarged view in Figs. 6 and 7. Figure 8 shows another exemplary embodiment, whereby the thickening 34 is here provided only as a nose, and does not run over the entire extension of the transverse edge, as in the exemplary embodiment according to Figs. 6 and 7.

In the exemplary embodiment shown in Fig. 9 of a covering membrane 18, the surface -- facing the connective tissue or, respectively, soft tissue shown at the top in the drawing -- of the covering membrane 18 comprises projections 36 and recesses 38 that are respectively fashioned in such a way that they can be clasped positively by collagen structures of the connective tissue growing in from above, by which means the retention of the connective tissue on the covering membrane 18 is improved.

In the modified exemplary embodiment in Fig. 10, the covering membrane 18 is constructed from a base layer 40 that faces the bone and a covering layer 42, whereby the latter comprises open micropores 44 that are likewise suited for the growing in of collagen structures.

In the exemplary embodiment of Fig. 11, it is provided that a backing layer 46 is located on the side of the base layer 40 that faces the covering layer 42, which backing layer likewise comprises open micropores 44 that are suited for the growing in of collagen structures from the location of the bone flaw.

In all the exemplary embodiments of the invention, it is possible, as warranted, to provide the covering membrane 18 with a reinforcement, e.g. in the form of a titanium mesh or the like, particularly in the region of the bone recess 20. The covering means can also be fixed to the bone material of the tooth 16 in the border region 22, either in the region of the bone recess 20 or, respectively, adjacent thereto, by means of fastening nails, preferably made of bioresorbable material, as is described e.g. in DE-PS 43 00 039.

The features of the invention disclosed in the above specification, in the drawings and in the claims can be essential -- both individually and in arbitrary combinations -- for the realization of the invention in its various embodiments.

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Patent claims

1. Apparatus for treating a bone recess formed in the region of the connection of the two limbs of a tooth bifurcation, with a flat covering means, having a front side and a back side, that comprises a covering membrane that operates in cell-occlusive fashion, for the temporary covering of the bone recess against the surrounding soft tissue, which covering means can be fastened to the tooth in the boundary region between the dental cement and the dental enamel, whereby the covering means comprises an affixing aid at its two distal transverse edges corresponding to the boundary region between the dental cement and the dental enamel, said affixing aid having a fastening means for the positive and/or non-positive affixing of the covering means to the tooth, characterized in that the covering means (18) comprises a narrowed region between the transverse edges, so that after being led between the limbs (12, 14) of the bifurcation it can be folded up in the direction towards the distal tooth end, and can be fastened using the fastening means (28, 30, 34) after being seated on the two tooth surfaces that are essentially parallel to the line of connection of the longitudinal midaxes of the two limbs.

2. Apparatus according to claim 1, characterized in that the fastening means comprises a cover (30) for the guiding through of a ligature thread (28) that is fixedly connected with the covering means (28) **[sic]** at at least one position.

3. Apparatus according to claim 1 or 2, characterized in that the covering means (18) comprises an interlocking projecting part (34) on at least one of its transverse edges, to be brought to engage in a recess that is present or can be produced in the boundary region (22) between the dental cement (24) and the dental enamel (16).

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4. Apparatus according to claim 3, characterized in that the interlocking projecting part has the form of a shoulder that projects, essentially in an L-shape, from the plane of the covering means in the direction towards the front side.

5. Apparatus according to claim 3, characterized in that the interlocking projecting part has the form of a hook-in nose that projects from the plane of the covering means (18) in the direction towards the front side.

6. Apparatus according to claim 3, characterized in that the interlocking projecting part has the form of a thickening (34) of the material of the covering membrane.

7. Apparatus according to claim 6, characterized in that the thickening (34) is fashioned in the form of a ledge.

8. Apparatus according to one of the preceding claims, characterized in that the fastening means (30) is fashioned in one piece with the covering membrane.

9. Apparatus according to one of the preceding claims, characterized in that the fastening means comprises an adhesive strip or the like on at least one of the transverse edges of the covering means (18).

10. Apparatus according to one of the preceding claims, characterized in that at least the covering membrane of the covering means (18) is made of bioresorbable material.

11. Apparatus according to claim 10, characterized in that the covering means (18) is made entirely of bioresorbable material.

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12. Apparatus according to one of the preceding claims, characterized in that the covering means (18) is fashioned so as to be expandable and compressible.

13. Apparatus according to one of the preceding claims, characterized in that the covering means (18) is of shrinkable construction, at least in the region of the transverse edges.

14. Apparatus according to claim 13, characterized in that the covering means (18) is of chemically shrinkable construction, at least in the region of the transverse edges.

15. Apparatus according to claim 13, characterized in that the covering means (18) is of thermally shrinkable construction, at least in the region of the transverse edges.

16. Apparatus according to one of the preceding claims, characterized in that the covering means (18) is preformed in bulged fashion.

17. Apparatus according to one of the preceding claims, characterized in that the covering means (18) comprises a reinforcement in its narrowed region.

18. Apparatus according to claim 17, characterized in that the reinforcement consists of a reinforcement mesh, such as titanium mesh or the like.

19. Apparatus according to one of the preceding claims, characterized in that the front side and/or the back side of the covering membrane (18) (each) comprise(s) a retention support apparatus (36, 38, 42, 44, 46), for the improvement of the retention of the soft tissue or, respectively, of the (respective) collagen structure(s) on the covering membrane (18).

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20. Apparatus according to claim 19, characterized in that the retention support apparatus(es) (respectively) comprise(s) at least one mechanical retention aid (36, 38).

21. Apparatus according to claim 20, characterized in that the mechanically acting retention aid(s) (36, 38) is/are constructed at least partially for positive clasping through soft tissue and/or collagen structure(s).

22. Apparatus according to claim 20 or 21, characterized in that the mechanical retention aid(s) is/are formed at least partially by means of projections (36) and/or recesses (38) of the covering membrane (18) of the covering means.

23. Apparatus according to one of claims 20 to 22, characterized in that the mechanical retention aid(s) is/are formed at least partially by means of surface irregularities of the covering membrane (18) of the covering means.

24. Apparatus according to one of claims 20 to 23, characterized in that the mechanical retention aids are formed at least partially by means of a woven-type and/or knit-type surface structure of the front side or, respectively, of the back side of the covering membrane (18) of the covering means.

25. Apparatus according to one of claims 19 to 24, characterized in that the retention support apparatus(es) is/are formed at least partially by corresponding selection of the chemical composition and/or the morphological structure of the material of the covering membrane (18) in the material of the front side or, respectively, of the back side of the covering membrane (18).

26. Apparatus according to one of claims 19 to 25, characterized by at least two layers (40, 42, 46) of different

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structure and/or composition, whereby at least one of the external layers (42, 46) comprise(s) the retention support apparatus(es) (44).

27. Apparatus according to claim 26, characterized by open micropores (44) provided in the external side(s) (42, 46).

28. Apparatus according to one of claims 19 to 27, characterized by retention support apparatuses provided on the external side(s), which enter into interaction on the molecular level with the soft tissue or, respectively, with the collagen structure(s), whereby the interaction is of a chemical and/or physical nature.

Fig.1

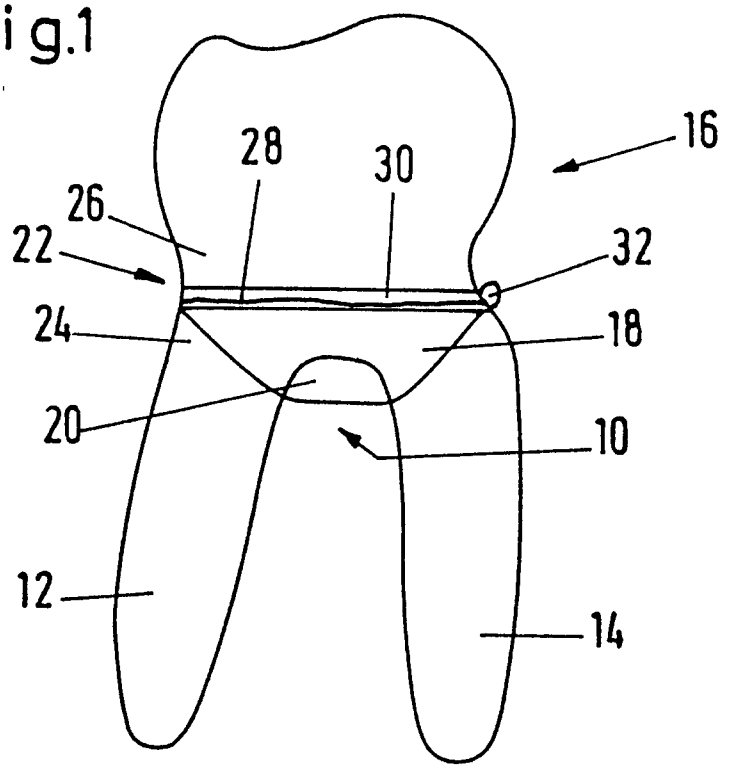
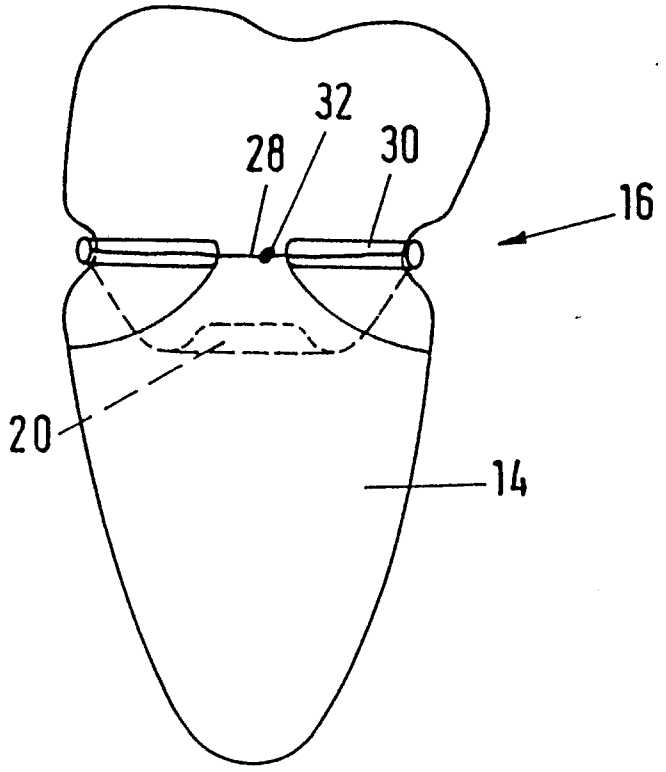


Fig.2



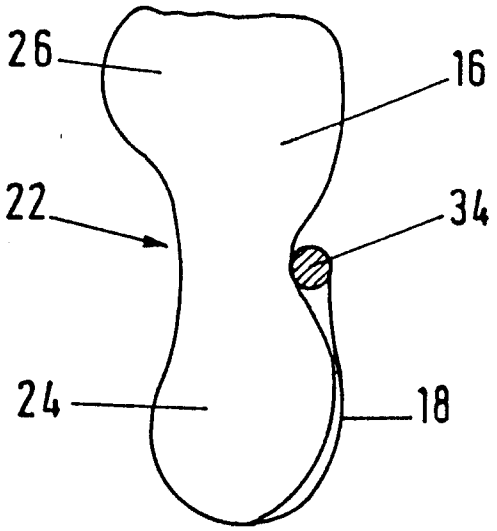


Fig.3

Fig.8

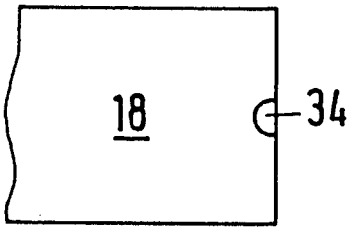


Fig.4

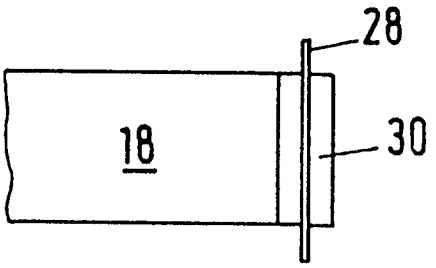


Fig.5

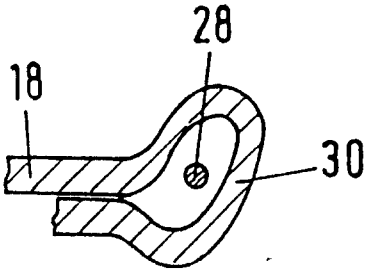


Fig.6

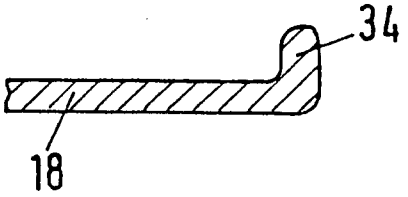


Fig.7

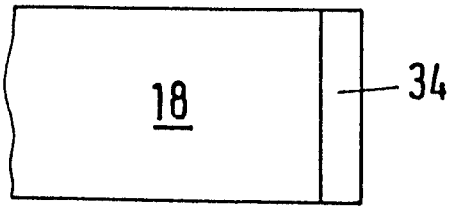


Fig.9

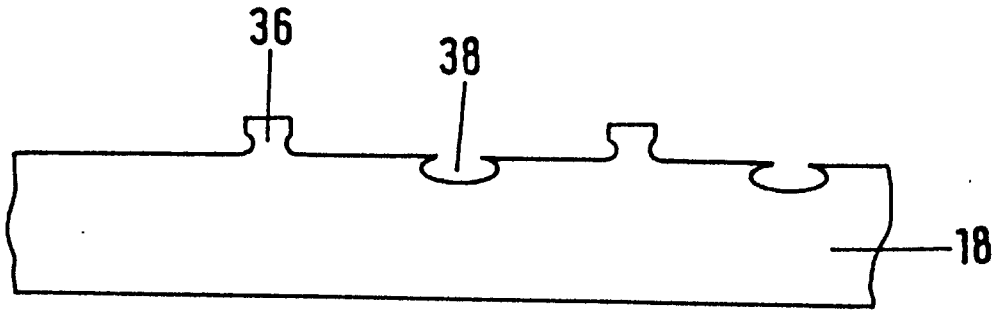


Fig.10

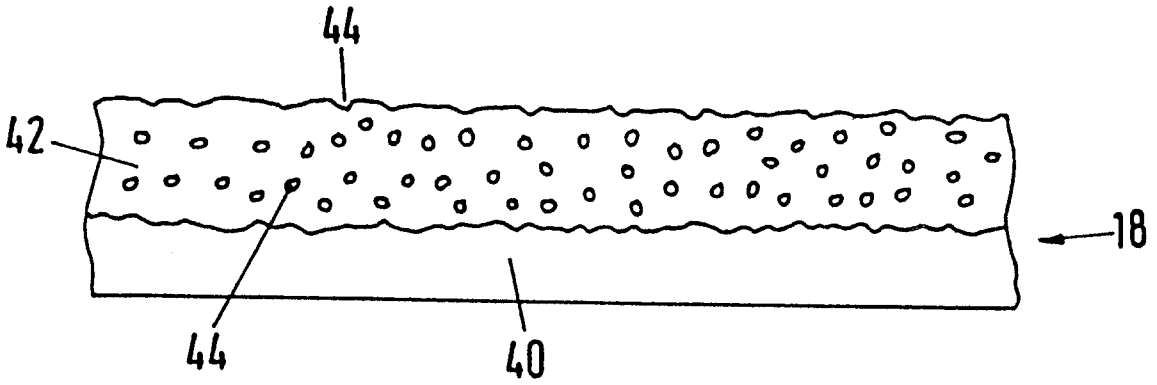
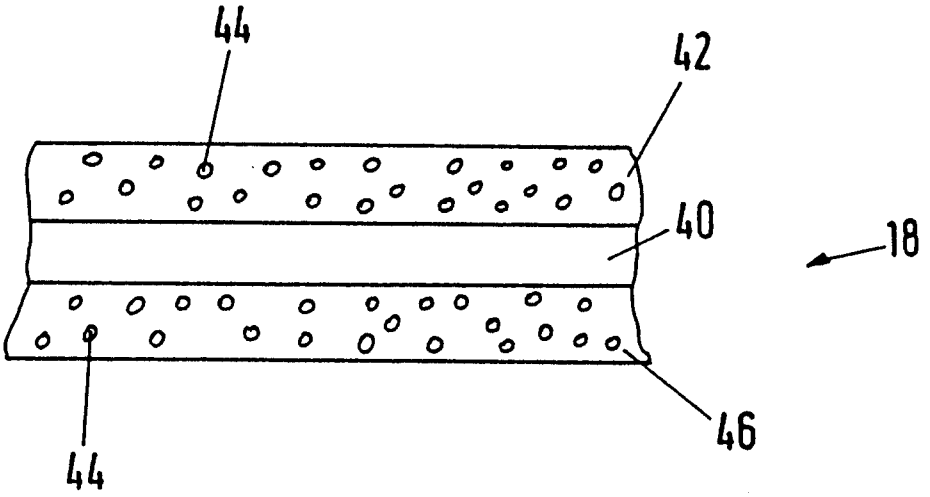
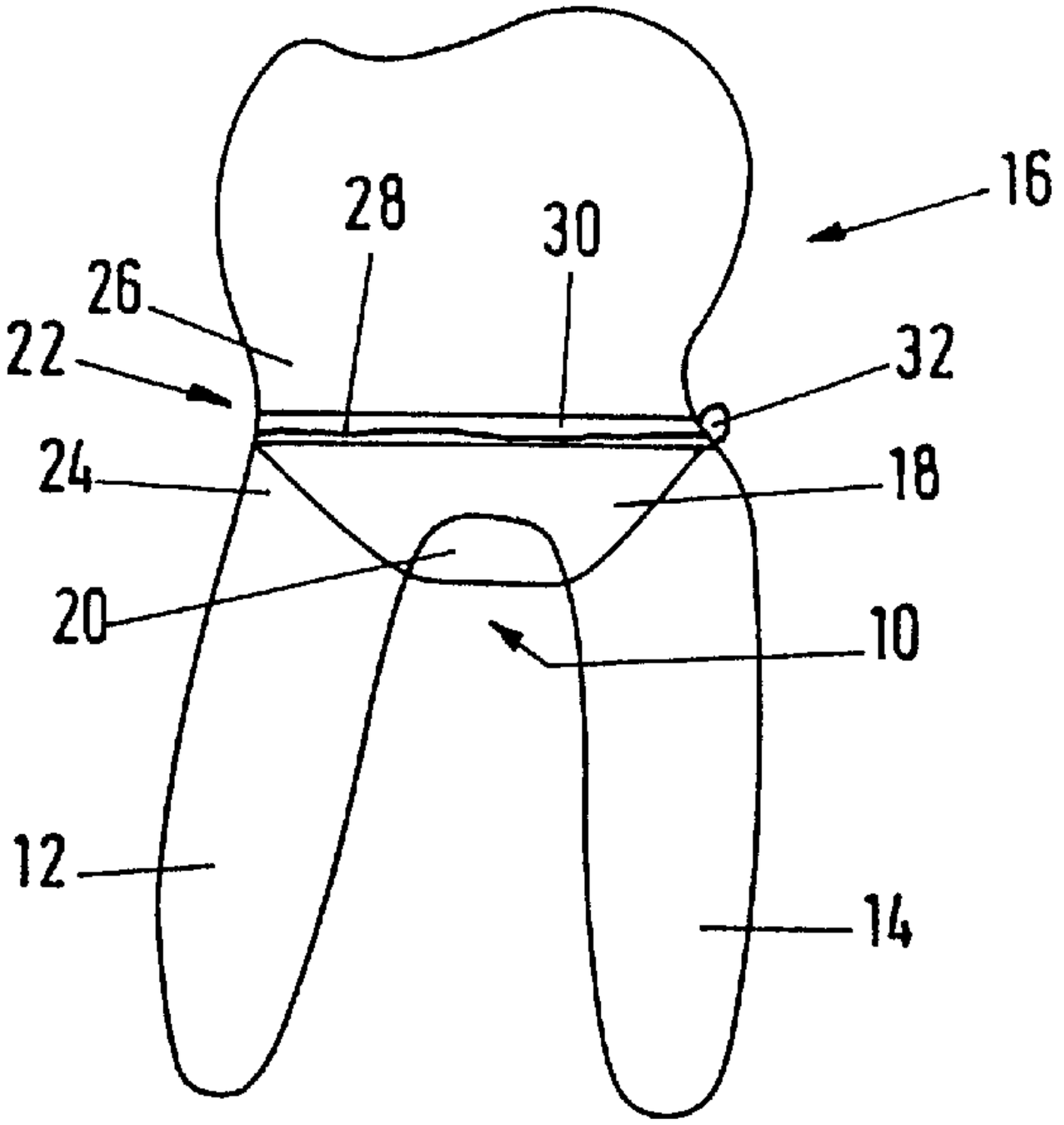


Fig.11




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