CLAIMS

1. A layered soft palate support, being a flat implant made of a material capable of being implanted into a human body for a long term, comprising:

a hard palate connecting end (1), configured with a connecting structure (11) connected with a hard palate; and

a support (2), being a layered structure formed by stacking two or more supporting plates (21) and capable of being inserted into a soft palate, and removably or irremovably fixed to the hard palate connecting end (1).

2. The layered soft palate support according to claim 1, wherein each supporting plate (21) is a thin-walled plate made of a medical-purpose elastic material and having a curvature matching the shape of the soft palate, and the thin-walled plate has a thickness of 0.01 mm to 1.5 mm, and preferably 0.01 mm to 0.8 mm.

3. The layered soft palate support according to claim 1, wherein the supporting plates (21) have a uniform or non-uniform wall thickness; and when the supporting plates (21) have a non-uniform wall thickness, the larger the length of a specific supporting plate (21) is, the larger the amplitude of swing is, and the smaller the wall thickness is.

4. The layered soft palate support according to claim 1, wherein the number M of layers of the stacked thin-walled supporting plates (21) at a near end of the layered soft palate support, that is, close to the hard palate connecting end (1), is greater than the number N of layers of the stacked thin-walled supporting plates (21) at a distal end of the layered soft palate support, that is, remote from the hard palate connecting end (1).

5. The layered soft palate support according to claim 1, wherein the supporting plates (21) of the layered structure are sequentially arranged in a descending order of length such that front supporting plates (21), that is, the supporting plates (21) close to teeth are longer than rear supporting plates (21), that is, the supporting plates (21) close to a posterior pharyngeal wall.

6. The layered soft palate support according to claim 1, wherein the supporting plates (21) of the layered structure are sequentially arranged in an ascending order of length such that front supporting plates (21), that is, the supporting plates (21) close to teeth are shorter than rear supporting plates (21), that is, the supporting plates (21) close to a posterior pharyngeal wall.

7. The layered soft palate support according to claim 1, wherein the supporting plates (21) of the layered structure are arranged in a sandwiched configuration such that the length of a frontmost supporting plate (21) is near or equal to the length of a rearmost supporting plate (21), and supporting plates (21) in-between the frontmost supporting plate (21) and rearmost supporting plate (21) are sequentially arranged in a descending order of length, are symmetrically arranged or are sequentially arranged in an ascending order of length.

8. The layered soft palate support according to claim 7, wherein when the supporting plates (21) of the layered structure are arranged in a sandwiched configuration such that the frontmost supporting plate (21) and the rearmost supporting plate (21) are formed by bending a single plate into a U-shape, and the supporting plates (21) in-between the frontmost supporting plate (21) and rearmost supporting plate (21) are sequentially arranged in a descending order of length, are symmetrically arranged or are sequentially arranged in an ascending order of length.

9. The layered soft palate support according to claim 1, wherein the supporting plate (21) is configured with through holes (22).

10. The layered soft palate support according to claim 1, wherein the layered soft palate support comprises a blunt edge (23).

11. The layered soft palate support according to claim 10, wherein the blunt edge (23) is a coil spring structure, wound in through holes (22) at an edge of the supporting plate (21), to connect the supporting plates (21).

12. The layered soft palate support according to claim 11, wherein the layered soft palate support comprises a blunt edge (23), and the blunt edge (23) comprises more than

one coil spring segment (231), wound in through holes (22) of the supporting plate (21), to connect the supporting plates (21).

13. The layered soft palate support according to claim 10, wherein the blunt edge (23) is flanges (232) of a concave-convex position-limiting engagement structure.

14. The layered soft palate support according to claim 1, wherein the layered soft palate support comprises a position-limiting mechanism (24) for limiting a distance between the layers of the supporting plates (21) of the layered support such that the supporting plates (21) are constrained by the position-limiting mechanism (24), the supporting plate (21) has a variable degree of curvature, a gap between the layers of the supporting plates (21) is limited by the position-limiting mechanism (24), and the gap is smaller than 2 mm.

15. The layered soft palate support according to claim 14, wherein the position-limiting mechanism (24) is a locking pin of a concave-convex position-limiting engagement structure, and formed by a lock nut (241) and a pin (242).

16. The layered soft palate support according to claim 14, wherein the position-limiting mechanism (24) is formed by a limiting groove (244) and a limiting plate (243), and the limiting plate (243) is part of an edge of one of the supporting plates (21), and is bent to form a rectangular or U-shaped slot opening serving as the limiting groove (244).

17. The layered soft palate support according to claim 1, wherein the layered soft palate support comprises an adjustment mechanism (25) capable of adjusting the degree of curvature of the supporting plate.

18. The layered soft palate support according to claim 17, wherein the adjustment mechanism (25) is a wedge-shaped adjustment mechanism (251); when the wedge-shaped adjustment mechanism (251) is moved toward a near end, the degree of curvature of the support (2) is increased, so as to increase a lifting degree of the soft palate; and when the wedge-shaped adjustment mechanism (251) is moved toward a distal end, the degree of curvature of the support (2) is reduced, so as to reduce the

lifting degree of the soft palate.

19. The layered soft palate support according to claim 17, wherein the adjustment mechanism (25) is an adjustment washer (252); when the height of the adjustment washer (252) is increased, the degree of curvature of the support (2) is increased, so as to increase a lifting degree of the soft palate; and when the height of the adjustment washer (252) is reduced, the degree of curvature of the support (2) is reduced, so as to reduce the lifting degree of the soft palate.

20. The layered soft palate support according to claim 1, wherein the medical-purpose elastic material of the supporting plate (21) is selected from a group consisting of amorphous alloy also referred to as metallic glass, titanium-zirconium-niobium alloy, titanium-nickel shape memory alloy, titanium and titanium alloy, medical grade stainless steel, and medical grade elastic non-metallic materials.

21. The layered soft palate support according to claim 20, wherein the amorphous alloy has excellent elasticity and excellent fatigue resistance, and is selected from a group consisting of Ti-based amorphous metal materials, Zr-based amorphous metal materials, Nb-based amorphous metal materials, and Fe-based amorphous metal materials.

22. The layered soft palate support according to claim 1, wherein the hard palate connecting end (1) has a length L1 of 5 to 30 mm, the support (2) has a length L2 of 15 mm to 60 mm, and a lifting angle β of the support (2), that is, an angle between a plane of the hard palate and a most distal end of the support (2), is 30° to 80°.

23. The layered soft palate support according to claim 1, wherein a bending radius R1 of a near end of the support (2), that is, close to the hard palate connecting end (1), is 10 mm to 100 mm; a bending radius R2 of a distal end of the support (2), that is, away from the hard palate connecting end (1), is 20 mm to 120 mm; and the near end of the support (2) has a thickness δ1 of 0.5 mm to 1.8 mm, and the distal end has a thickness δ2 of 0.1 mm to 0.8 mm.

24. The layered soft palate support according to claim 1, wherein a sweepback angle γ of a warped end (211) at a distal end of the support (2), that is, an angle γ between a plane of the supporting plate (21) at the distal end of the support (2) and a plane of the warped end (211), is 0° to 75°, and preferably 20° to 50°.

25. The layered soft palate support according to claim 1, wherein the connecting structure (11) of the hard palate connecting end is a through hole (111) through which the hard palate connecting end (1) is fixed to the hard palate (6) by using a screw.

26. The layered soft palate support according to claim 1, wherein the hard palate connecting end (1) comprises a fixing rivet (26) for riveting the supporting plates (21) located at the hard palate connecting end.

27. A implantation method of a layered soft palate support, comprising: making a small incision at a junction of a soft palate (7) and a hard palate (6), and inserting a support (2) into a muscular layer at a middle portion of the soft palate (7); and passing a medical bone nail (5) through a through hole (111) on a hard palate connecting end (1) to fix the hard palate connecting end (1) to the hard palate (6).

28. The implantation method according to claim 27, wherein the layered soft palate support is implanted in two stages, wherein in a first stage, the hard palate connecting end (1) of the layered soft palate support is implanted first, and the bone nail (5) is passed through the through hole (111) on the hard palate connecting end (1) to fix the hard palate connecting end (1) to the hard palate (6); and one month to three months later, the hard palate connecting end (1) is firmly fixed to the hard palate (6), and at this time, a second stage surgery is performed: making a small incision at the junction of the soft palate (7) and the hard palate (6), inserting one end of the support (2) into the muscular layer at the middle portion of the soft palate (7), and fixing the other end of the support (2) to the hard palate connecting end (1).

The claims defining the invention are as follows:

1. A layered soft palate support, being a flat implant made of a material capable of being implanted into a human body for a long term, comprising:

a hard palate connecting end, configured with a connecting structure connected with a hard palate; and

a support, being a layered structure formed by stacking two or more supporting plates and capable of being inserted into a soft palate, and removably or irremovably fixed to the hard palate connecting end,

wherein the number M of layers of the stacked thin-walled supporting plates at a near end of the layered soft palate support, that is, close to the hard palate connecting end, is greater than the number N of layers of the stacked thin-walled supporting plates at a distal end of the layered soft palate support, that is, remote from the hard palate connecting end.

2. The layered soft palate support according to claim 1, wherein each supporting plate is a thin-walled plate made of a medical-purpose elastic material and having a curvature matching the shape of the soft palate, and the thin-walled plate has a thickness of 0.01 mm to 1.5 mm, and preferably 0.01 mm to 0.8 mm.

3. The layered soft palate support according to claim 1 or claim 2, wherein the supporting plates have a uniform or non-uniform wall thickness; and when the supporting plates have a non-uniform wall thickness, the larger the length of a specific supporting plate is, the larger an amplitude of swing is, and the smaller the wall thickness is.

4. The layered soft palate support according to any one of the preceding claims, wherein the supporting plates of the layered structure are sequentially arranged in a descending order of length such that front supporting plates, that is, the supporting plates close to teeth are longer than rear supporting plates, that is, the supporting plates close to a posterior pharyngeal wall.

5. The layered soft palate support according to any one of claims 1 to 3, wherein the supporting plates of the layered structure are sequentially arranged in an ascending order of length such that front supporting plates, that is, the supporting plates close to teeth are shorter than rear supporting plates, that is, the supporting plates close to a posterior pharyngeal wall.

6. The layered soft palate support according to any one of claims 1 to 3, wherein the supporting plates of the layered structure are arranged in a sandwiched configuration such that the length of a frontmost supporting plate is near or equal to the length of a rearmost supporting plate, and supporting plates in-between the frontmost supporting plate and rearmost supporting plate are sequentially arranged in a descending order of length, are symmetrically arranged or are sequentially arranged in an ascending order of length.

7. The layered soft palate support according to claim 6, wherein when the supporting plates of the layered structure are arranged in a sandwiched configuration such that the frontmost supporting plate and the rearmost supporting plate are formed by bending a single plate into a U-shape, and the supporting plates in-between the frontmost supporting plate and rearmost supporting plate are sequentially arranged in a descending order of length, are symmetrically arranged or are sequentially arranged in an ascending order of length.

8. The layered soft palate support according to any one of the preceding claims, wherein the supporting plate is configured with through holes.

9. The layered soft palate support according to any one of the preceding claims, wherein the layered soft palate support comprises a blunt edge.

10. The layered soft palate support according to claim 9, wherein the blunt edge is a coil spring structure, wound in through holes at an edge of the supporting plate, to connect the supporting plates.

11. The layered soft palate support according to claim 9 or claim 10, wherein the layered soft palate support comprises a blunt edge, and the blunt edge comprises more than one coil spring segment, wound in through holes of the supporting plate, to connect the supporting plates.

12. The layered soft palate support according to any one of claims 9 to 11, wherein the blunt edge is flanges of a concave-convex position-limiting engagement structure.

13. The layered soft palate support according to any one of the preceding claims, wherein the layered soft palate support comprises a position-limiting mechanism for limiting a distance between the layers of the supporting plates of the layered support such that the supporting plates are constrained by the position-limiting mechanism, the supporting plate has a variable degree of curvature, a gap between the layers of the supporting plates is limited by the position-limiting mechanism, and the gap is smaller than 2 mm.

14. The layered soft palate support according to claim 13, wherein the position-limiting mechanism is a locking pin of a concave-convex position-limiting engagement structure, and formed by a lock nut and a pin.

15. The layered soft palate support according to claim 13, wherein the position-limiting mechanism is formed by a limiting groove and a limiting plate, and the limiting plate is part of an edge of one of the supporting plates, and is bent to form a rectangular or U-shaped slot opening serving as the limiting groove.

16. The layered soft palate support according to any one of the preceding claims, wherein the layered soft palate support comprises an adjustment mechanism capable of adjusting the degree of curvature of the supporting plate.

17. The layered soft palate support according to claim 16, wherein the adjustment mechanism is a wedge-shaped adjustment mechanism; when the wedge-shaped adjustment mechanism is moved toward a near end, the degree of curvature of the support is increased, so as to increase a lifting degree of the soft palate; and when the wedge-shaped adjustment

mechanism is moved toward a distal end, the degree of curvature of the support is reduced, so as to reduce the lifting degree of the soft palate.

18. The layered soft palate support according to claim 16, wherein the adjustment mechanism is an adjustment washer; when the height of the adjustment washer is increased, the degree of curvature of the support is increased, so as to increase a lifting degree of the soft palate; and when the height of the adjustment washer is reduced, the degree of curvature of the support is reduced, so as to reduce the lifting degree of the soft palate.

19. The layered soft palate support according to any one of the preceding claims, wherein the medical-purpose elastic material of the supporting plate is selected from a group including amorphous alloy also referred to as metallic glass, titanium-zirconium-niobium alloy, titanium-nickel shape memory alloy, titanium and titanium alloy, medical grade stainless steel, and medical grade elastic non-metallic materials.

20. The layered soft palate support according to claim 19, wherein the amorphous alloy has excellent elasticity and excellent fatigue resistance, and is selected from a group including Ti-based amorphous metal materials, Zr-based amorphous metal materials, Nb-based amorphous metal materials, and Fe-based amorphous metal materials.

21. The layered soft palate support according to any one of the preceding claims, wherein the hard palate connecting end has a length L1 of 5 to 30 mm, the support has a length L2 of 15 mm to 60 mm, and a lifting angle β of the support, that is, an angle between a plane of the hard palate and a most distal end of the support, is 30° to 80°.

22. The layered soft palate support according to any one of the preceding claims, wherein a bending radius R1 of a near end of the support, that is, close to the hard palate connecting end, is 10 mm to 100 mm; a bending radius R2 of a distal end of the support, that is, away from the hard palate connecting end, is 20 mm to 120 mm; and the near end of the support has a thickness δ1 of 0.5 mm to 1.8 mm, and the distal end has a thickness δ2 of 0.1 mm to 0.8 mm.

23. The layered soft palate support according to any one of the preceding claims, wherein a sweepback angle γ of a warped end at a distal end of the support, that is, an angle γ between a plane of the supporting plate at the distal end of the support and a plane of the warped end, is 0° to 75°, and preferably 20° to 50°.

24. The layered soft palate support according to any one of the preceding claims, wherein the connecting structure of the hard palate connecting end is a through hole through which the hard palate connecting end is fixed to the hard palate by using a screw.

25. The layered soft palate support according to any one of the preceding claims, wherein the hard palate connecting end comprises a fixing rivet for riveting the supporting plates located at the hard palate connecting end.

26. An implantation method for a layered soft palate support according to any one of claims 1 to 25, comprising: making a small incision at a junction of a soft palate and a hard palate, and inserting the support into a muscular layer at a middle portion of the soft palate; and passing a medical bone nail through a through hole on the hard palate connecting end to fix the hard palate connecting end to the hard palate.

27. The implantation method according to claim 26, wherein the layered soft palate support is implanted in two stages, wherein in a first stage, the hard palate connecting end of the layered soft palate support is implanted first, and the bone nail is passed through the through hole on the hard palate connecting end to fix the hard palate connecting end to the hard palate; and one month to three months later, the hard palate connecting end is firmly fixed to the hard palate, and at this time, a second stage surgery is performed including: making a small incision at the junction of the soft palate and the hard palate, inserting one end of the support into the muscular layer at the middle portion of the soft palate, and fixing the other end of the support to the hard palate connecting end.