This invention relates to dental prosthesis and particularly to prosthetic appliances implanted beneath the periosteum and around the jawbone to provide a firm and comfortable anchor for artificial teeth.

In prosthodontia, the objective is to approach as closely as possible the firmness and comfort with which healthy natural teeth are held within the mouth. Achievement of this objective requires that a denture or single artificial tooth be firmly held so that it withstands without wobble or movement the normal oral activities of the wearer.

One common practice with edentulous or partially edentulous patients is to utilize either a full removable denture or a partial removable denture in which the dentures, being merely fitted to the gums without implanting, are not, however, firmly anchored to the extent that all problems arising from oral activities are eliminated. Where one or possibly two teeth are to be replaced, a permanent bridge consisting of an artificial tooth supported by inlays cemented to adjacent natural teeth is commonly used. While the permanent bridge provides a firm anchor supporting the artificial tooth, the removal of portions of healthy teeth to provide a structure for supporting the anchoring inlays is not entirely desirable. Furthermore, the solid mass of the artificial tooth and the inlays introduces problems both as to dental hygiene of the adjacent natural teeth and, since the inlays are metallic, to subsequent X-ray examination of the anchoring natural teeth.

The above described problems attendant upon utilization of dentures or bridges has led to implanting of prosthetic appliances within gum tissue so as to provide an anchor for dentures. By one technique, an intra-oral incision is made in the gum tissues so as to expose the lower jawbone. Appropriate longitudinal and lateral grooves are drilled into the upper portion of the jawbone and an impression is made of the jawbone and the grooves therein. From this impression, a metal plate is cast so that the plate itself, when laid upon the upper portion of the jawbone, conforms to the bone and the grooves therein. A number of spaced apart pins are joined to the plate so as to project from its upper surface. When the surgery is completed by closing the incision in the gum tissues, the plate is held on top of the jawbone by the tissues. A portion of each of the spaced apart pins projects above the gum tissue surface so that artificial teeth can be adapted to the pins and supported thereon.

The technique of implanting a metal plate as described above presents certain disadvantages. In the first instance, the making of a proper impression is difficult because of the metal environment in which the impression must be made. In the second instance, at least two separate operations are required, the first to secure the impression for the metal casting and the second to implant the metal casting. Furthermore, as is apparent from the description of the technique, the only anchor for the plate is that provided by the conformation of the plate to the grooves formed in the jawbone.

In another technique of implanting prosthetic appliances within gum tissue, an intra-oral incision is made in the gum tissue and a magnetic insert is placed within the gum tissue so as to be between the surface of the gum tissue and the lower jawbone after the incision is closed. A metallic plug, cast within an artificial tooth, holds the tooth to the gum tissue by reason of the magnetic attrac-

tion exerted by the implanted magnetic insert upon the metallic plug within the tooth.

The present invention is a dental prosthetic appliance which is a subperiosteal implant around the jawbone. By implanting this device in one operation of relatively short duration, a firm but comfortable anchor for artificial teeth is provided. The prosthetic appliance is particularly applicable for the replacement of one, several, or all of the mandibular teeth. For convenience, the appliance of the present invention is described below with reference to replacement of a single tooth. It will be understood, however, that it may also readily be used for replacement of several or all of the mandibular teeth, as will later be described.

The dental prosthetic appliance of the present invention comprises a flexible band, first means fixed at one end to the band to project above a surface of said band, and second means at the other end of said first means and adapted to hold an artificial tooth. In its presently preferred form, the dental prosthetic appliance of the present invention comprises a flexible metallic band having a plurality of perforations spaced apart within the band. A threaded bolt, locked to the band, extends upwardly from one surface of the band. A cone-shaped cap, threadably fitted to the upper end of the bolt, provides a fitting to receive a correspondingly cone-shaped recess formed within an artificial tooth. The surface defining the recess within the artificial tooth may be snapped over the cap to lock securely the tooth to the prosthetic appliance.

The method of implanting the prosthetic appliance of the present invention consists of making an intra-oral incision in the gum tissue above the lower jawbone and laying back the tissue so that the jawbone is exposed. One end of the metallic band is inserted beneath the jawbone and is brought around it until it is adjacent or slightly overlies the other end of the band. The band is adjusted around the jawbone until the threaded bolt projects substantially vertically above the jawbone. The two ends of the band are then joined together by wiring or other suitable means so that the band is securely positioned around the jawbone and anchored thereby. When the incision is closed, only an upper portion of the threaded bolt protrudes above the surface of the gum tissue. An artificial tooth is suitably adapted so that it can be securely mounted on the upper portion of the threaded bolt.

The prosthetic appliance of the present invention together with its advantages and method of use will be more clearly understood from the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a plan view of one embodiment of the prosthetic appliance of the present invention;

FIG. 2 is a perspective view of a portion of the lower jawbone with the embodiment of the prosthetic appliance shown in FIG. 1 secured in place;

FIG. 3 is an elevational view of the embodiment of the prosthetic appliance shown in FIG. 1 with the components thereof separately shown and partially broken away and sectioned;

FIG. 4 is a plan view of another embodiment of the prosthetic appliance of the present invention; and

FIG. 5 is an elevational view of yet another embodiment of the prosthetic appliance of the present invention with the components thereof separately shown and partially broken away and sectioned.

With reference to FIGS. 1, 2, and 3, the embodiment of the prosthetic appliance of the present invention shown comprises a flexible metallic band having a plurality of circular perforations spaced apart over the length of the band. A laterally centered bore 14 is positioned near one end of the band. A bolt 16 having a threaded
3,082,525 shaft 18 and a flat head 20 provides a vertical projection above the metallic band by passing the threaded shaft through bore 14 so that the head of the bolt abuts the underside of the band. A collar 22, having an internally threaded bore 24 and a skirt 26, is threadably fitted on shaft 18 until the skirt abuts the upper side of the band, thereby securely joining the bolt to the band. The length of collar 22 relative to the threaded shaft of the bolt leaves a portion of the shaft extending above the collar. A cone-shaped cap 28 having a substantially cylindrically shaped base portion 30 and an internally threaded bore 33 is threaded on the shaft of the bolt until its base portion abuts the collar.

After the prosthetic appliance is mounted, in place around the jawbone in the manner to be hereinafter described, an artificial tooth, generally shown by the dotted lines in FIG. 3 and identified by reference character 34, is snapped onto cone-shaped cap 24 by fitting a recess 36 in the tooth over the cap. The recess in the artificial tooth is shaped to correspond to the shape of cap 24 so that a friction fit is provided between the surface of the cap and the surface defining the recess in the tooth. It will be apparent that various means may be employed for locking the artificial tooth to the cap of the prosthetic appliance. For example, a resilient spring member or detent may be embodied in the artificial tooth so that it snaps into an appropriately positioned groove in the surface of the cap. Other locking means within the scope of the invention will be apparent to those skilled in the art.

The prosthetic appliance of the present invention is mounted around the lower jawbone, a portion of which is shown in FIG. 2 and identified by reference character 38. In the use of the prosthetic appliance of the present invention, an intra-oral incision is made in the gum tissue above the lower jawbone and the tissue is laid back so as to expose the jawbone. The end of the metallic band more remote from bolt 16 is fitted beneath the jawbone and brought around the jawbone until that end is near the other end of the band. The band may be conveniently made of a length such that it is adapted to fit jawbones of varying circumferences. After the band is placed so as to circumscribe the jawbone, any excess length may be snipped off so that the length of the band is approximately equal to or slightly greater than the circumference of the jawbone. The band is then tightened to fit it closely to the jawbone and the two ends of the band are joined together. The ends of the band may be joined together by wire wound through perforations at each end of the band and tied together, as particularly shown in FIG. 2, or, in the alternative, by spot welding the ends of the band together through the use of welding apparatus which makes it feasible to perform such welding intra-orally. When the welding technique is used, the length of the band must be slightly greater than the circumference of the jawbone to provide an overlay to be welded together. The band is positioned around the jawbone so that the bolt extends substantially vertically from the jawbone. The incision is then closed and only a portion of collar 22 protrudes above the surface of the gum tissue. In addition, cap 28 extends above the surface of the gum tissue. Preferably, the length of bolt 16 is such that a small portion of the collar and the cap extend above the gum tissue. In this manner, the artificial tooth can be formed in a position on the cap, it extends below the base portion of the cap and is in contact with the surface of the gum tissue.

After the prosthetic appliance has been positioned in the manner described and the surgery has been completed, the artificial tooth may be snapped onto the cap so as to be securely fitted in place. It has been found that slight adjustments in the vertical position of the bolt may be made even after completion of surgery, when such adjustments are necessary for correction of the bite and mating with upper teeth. The perforations in the band of the prosthetic appliance enable the growth of fibrous and vascular tissues through the band, thus so that within a relatively short time the restorative powers of the body firmly bond the band to the jawbone so that it becomes, in effect, an integral part of the jawbone.

It will be apparent from the foregoing description that a partial or full denture may be attached to the lower jaw by the expedient of spacing apart several of the prosthetic appliances of the present invention. For example, two of the appliances on opposite sides of the jawbone and a single appliance mounted to the jawbone at the chin point are sufficient to hold securely a full lower denture. Furthermore, it is feasible to band a wide band having two laterally adjacent bolts joined to the band. In this manner, two individually mounted artificial teeth may be positioned side by side within the mouth.

In the embodiment of the prosthetic appliance of the invention shown in FIG. 4, a flexible band 49 having a plurality of perforations 42 includes a threaded bolt 44 and a cone-shaped cap 46 joined to the band in a manner identical to that described with reference to the embodiment of the prosthetic appliance shown in FIGS. 1–5. A wire 50 is welded to the tapered point. This embodiment of the invention conveniently enables the threading of the band around the jawbone during implanting of the prosthetic appliance. By use of an appropriately rounded wire, the wire can be threaded under the jawbone so that the band may then be pulled beneath and around the jawbone so as to circumscribe it. In other respects, the implanting and utility of the embodiment shown in FIG. 4 is the same as has been previously described with reference to the embodiment shown in FIGS. 1–5.

In another embodiment of the invention shown in FIG. 5, a flexible metallic band 60 includes a plurality of perforations 62 and may be identical in structure to the band of the embodiment shown in FIG. 1 or the embodiment of the band shown in FIG. 4. A partially threaded shaft 64 is fitted within a laterally centered bore 66 positioned near one end of the band. The shaft is rigidly joined as by welds 68 to the band. The upper portion of the shaft is threaded to receive a cone-shaped cap 70 including an internally threaded bore 72. In the embodiment of FIG. 5, the use of a collar to secure the bolt to the band is eliminated and the diameter of the member passing through the surface of the gum tissue is minimized. The upper portion of shaft 64 is threaded only to the extent necessary to enable cap 70 to be threaded onto the shaft until its upper end coincides with the upper end of shaft 64. In other respects, the implanting and utility of the embodiment shown in FIG. 5 is the same as have been described with reference to the other embodiments of the prosthetic appliance of the present invention.

The dental prosthetic appliance of the present invention possesses the advantage that the supporting member, namely, the band, is secured around a rigid bone structure. This anchoring effect is enhanced by the provision of perforations in the band so as to enable the growth of tissue which bonds the band firmly to the jawbone. Furthermore, the prosthetic appliance of the present invention may be inserted and made ready for use in that when mounted upon a tooth, the upper and lower teeth are made ready for use in the fabrication of the prosthetic appliance. The firmness and comfort with which artificial teeth may be held in the mouth through the use of the prosthetic appliance of this invention makes its use particularly advantageous in prosthodontia.
I claim:

1. A prosthetic appliance comprising a flexible band having a plurality of perforations, first means fixed at one end to the band to project above a surface of said band, and second means at the other end of said first means and adapted for holding an artificial tooth.

2. A prosthetic appliance for intra-oral implant in the periosteum and around a jawbone to provide an anchor for artificial teeth comprising a flexible band having a length adapted to circumscribe the jawbone, first means fixed at one end to the band to extend above the surface of the periosteum when the band is around the jawbone, and second means at the other end of the first means and adapted for holding an artificial tooth.

3. Appliance in accordance with claim 2 wherein the flexible band has a tapered end and a wire joined to the point of the tapered end.

4. Appliance in accordance with claim 2 wherein the flexible band has a plurality of spaced apart perforations.

5. A prosthetic appliance for intra-oral implant in the periosteum and around a jawbone to provide an anchor for artificial teeth comprising a flexible band having a length adapted to circumscribe the jawbone, a threaded shaft fixed at one end to the band to extend above the surface of the periosteum when the band is around the jawbone, and a cap threadably secured to the other end of the shaft and adapted for holding an artificial tooth.

6. A prosthetic appliance comprising a flexible band having a plurality of perforations, a shaft fixed at one end to the band to project above a surface of the band, and a cap secured to the other end of the shaft and adapted for holding an artificial tooth.

7. A prosthetic appliance comprising a flexible band having a plurality of perforations, a bolt including a threaded shaft, a collar threaded on said shaft to lock the bolt to the band whereby the shaft projects above a surface of the band, and a cap threaded on said shaft above the collar and adapted for holding an artificial tooth.

8. In combination with at least one artificial tooth including a surface defining a recess, a prosthetic appliance comprising a flexible band having a plurality of perforations, at least one shaft fixed at one end to the band to project above a surface of the band, and a cap secured to the other end of the shaft and shaped to frictionally engage the surface defining the recess in the artificial tooth.

9. A method of implanting a dental prosthetic appliance around a jawbone comprising the steps of making an intra-oral incision in the gum tissue above the lower jawbone, laying back the tissue to expose the jawbone, inserting beneath the jawbone one end of a flexible band having a shaft attached thereto, bringing said end of the band around the jawbone until it is substantially adjacent to the other end of the band and the band substantially circumscribes the jawbone, adjusting the band until the shaft projects substantially vertically above the jawbone, and joining together the ends of the band to anchor it around the jawbone.

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