

[54] **ORTHODONTIC ONLAY AND METHOD FOR EXERTING CORRECTIVE TRACTION ON AN IMPACTED TOOTH**

3,468,031 9/1969 Muman..... 32/61

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[57] **ABSTRACT**

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An orthodontic onlay which is cemented directly to an impacted tooth to aid in exerting corrective traction thereon. A curved base surface has a curvature substantially the same as an incisal portion of the tooth involved. The onlay has a series of openings or recesses leading from that surface toward the opposite surface for receiving and holding cement, thereby increasing the bond between the tooth and the onlay when the cement is applied. Bonding strength is increased further by plasma processing the surface, especially when the onlay is made from plastic. On its opposite surface the onlay has means for attaching a ligature.

[52] U.S. Cl. .... 32/14 E, 32/61

[51] Int. Cl. .... A61c 3/10

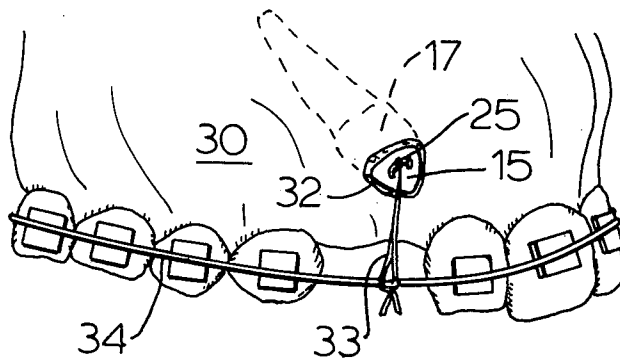
[58] Field of Search..... 32/14 E, 14 A, 17, 61, 32/71

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**17 Claims, 12 Drawing Figures**



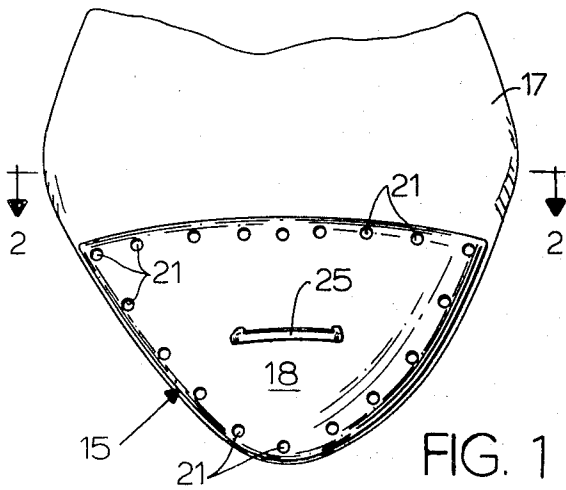


FIG. 1

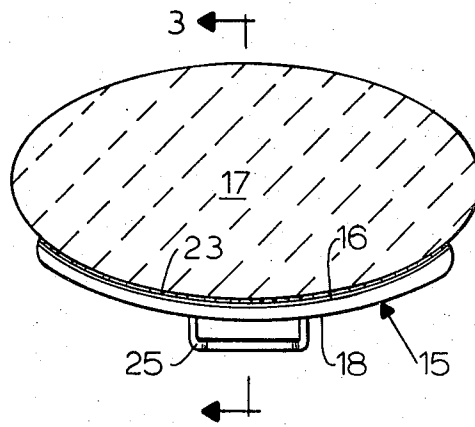


FIG. 2

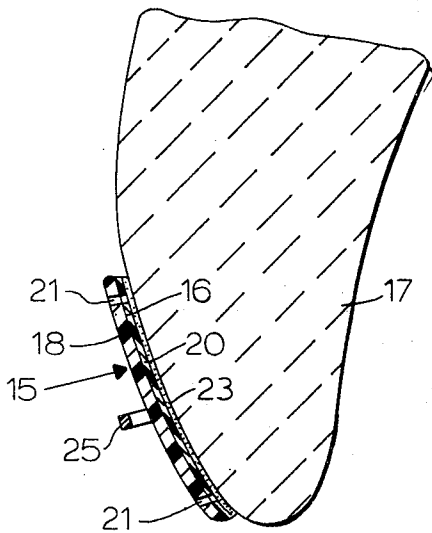


FIG. 3

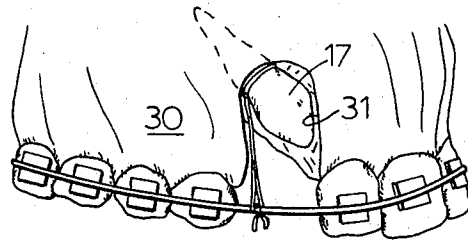


FIG. 4

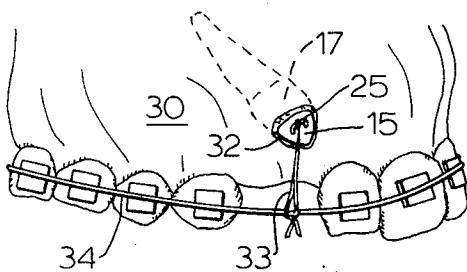


FIG. 6

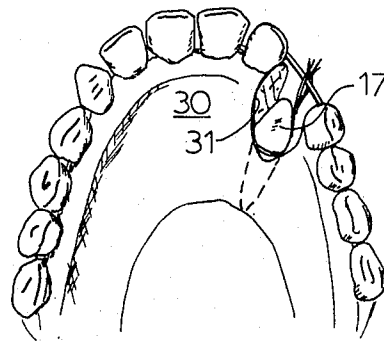


FIG. 5

FIG. 7

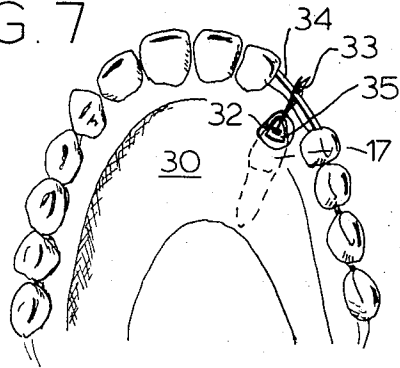


FIG. 8

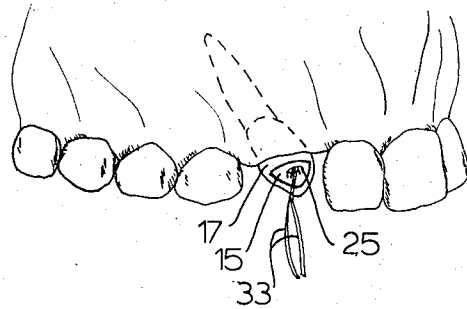


FIG. 9

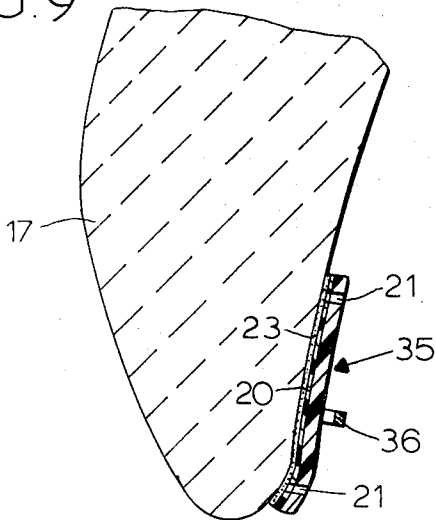


FIG. 11

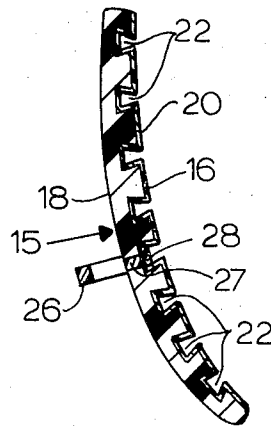


FIG. 10

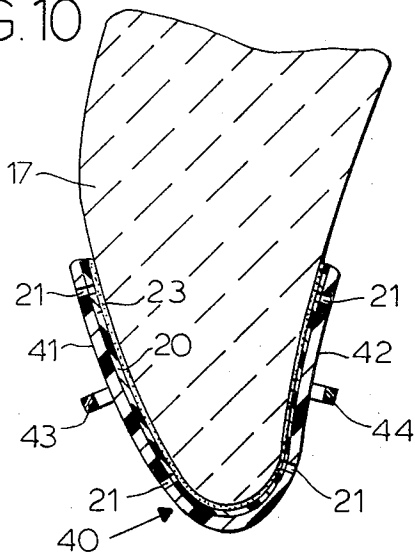
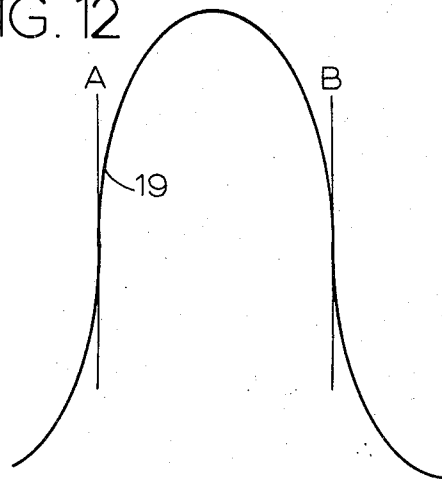


FIG. 12



## ORTHODONTIC ONLAY AND METHOD FOR EXERTING CORRECTIVE TRACTION ON AN IMPACTED TOOTH

### BACKGROUND OF THE INVENTION

Sometimes teeth fail to erupt. The problem is especially common with upper cuspid teeth, and in many patients these fail to erupt. Currently, such teeth are completely exposed surgically and then brought down into place by traction. This operation involves the loss of much supporting bone, as well as tissue. The traction on the exposed tooth is achieved with a chain that is tied around the neck of the tooth, and pressure is applied to the chain to pull the tooth into position. Frequently the chain has come loose and for that reason, and sometimes others, secondary surgery has been required. Even following surgery, bony defects have often remained that have never been corrected.

### BRIEF SUMMARY OF THE INVENTION

The invention comprises a specialized orthodontic onlay, preferably made of plastic, and secured by cement (such as a suitable epoxy cement) directly to the tooth. By use of this invention it is no longer necessary to remove bone from the entire crown. Instead, a small window incision is sufficient to gain access and to enable the desired traction.

In the use of brackets applied to teeth for other purposes, it has heretofore been difficult to gain sufficient adhesion to enable these small articles to transmit a substantial amount of traction, but in this invention the plastic onlay is applied by cement with the aid of a special plasma-processed surface and a series of openings from the surface to be cemented, which may lead through the base of the bracket, or partway through it, and which hold additional cement and thereby enable a strong bonding force to be applied. The base surface that is to be applied to the tooth is shaped to a curvature substantially the same as the portion of the tooth to which it is to be adhered, and on the opposite surface is provided means for attaching a ligature.

The present invention results in tremendous saving of surgical trauma, and also greatly reduces the amount of bone and tissue that are removed. The onlay need be placed on only about one-third of the cuspid crown.

### BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a view in front elevation of an onlay embodying the principles of the invention secured to the lower portion of a cuspid tooth. The drawing is greatly enlarged.

FIG. 2 is a view taken along the line 2—2 in FIG. 1.

FIG. 3 is a view in section taken along the line 3—3 in FIG. 2.

FIG. 4 is a view in front elevation illustrating the prior art, showing an upper row of teeth with an impacted cuspid to which a chain has been tied, after removal of a considerable amount of bone and tissue.

FIG. 5 is a view in bottom plan of the same prior art situation.

FIG. 6 is a view similar to FIG. 4 showing the application of the present invention, where only a small amount of tissue and bone are removed, and onlay of

this invention set in place, and a ligature secured thereto.

FIG. 7 is a view similar to FIG. 5 showing the application of the present invention.

FIG. 8 is a view similar to FIG. 6 illustrating the position somewhat later, after the application of the ligature has helped the tooth erupt. At this point, the onlay may be removed and the eruption continued to be assisted by braces until the tooth reaches a substantially normal position.

FIG. 9 is a view similar to FIG. 3 showing a modified form of the invention applied to the rear surface of a cuspid.

FIG. 10 is a view similar to FIG. 9 showing another modified form of the invention wherein the onlay encloses the whole lowermost portion of the cuspid on all surfaces.

FIG. 11 is a further enlarged view of a modified form of onlay having recesses instead of through openings in order to secure improved cement bonding, as compared with a smooth surface.

FIG. 12 is an error curve indicating distribution of tooth shapes.

### DETAILED DESCRIPTION OF THE INVENTION

The invention comprises an onlay 15 preferably made from plastic approximately the color of the tooth, and shaped to provide a base surface 16 that is adapted to face the surface of a tooth 17 and an opposite surface 18 which faces outwardly. As illustrated, the tooth 17 is a cuspid or incisor, which is the commonest tooth to have the problem, and where the most severe problems have been confronted. The plastic may be methyl methacrylate or other suitable material.

The onlay 15 is shaped to conform to the shape of the incisal third of the tooth 17 to which it is to be applied. Thus, as shown in FIG. 3, the onlay 15 is curved from top to bottom and as shown in FIG. 2, it is also curved from side to side, to conform to the double curve of the tooth 17. The size and shape of the onlay 15 are important, for it should conform very closely to the size and shape of the tooth 17 to which it is applied. Fortunately, as shown in FIG. 12, a distribution curve 19 of teeth size follows the familiar error curve, with nine-tenths of the teeth being located between the two vertical divisions A and B, indicating that a single size of tooth onlay 15 made to a proper shape will fit the teeth of nine-tenths of all people. For approximately one-tenth of them, the onlay 15 would be either too curved or not curved enough, but this can be corrected by use of a dental burr by the orthodontist or surgeon.

The shape of the onlay 15 having been determined, an important feature of the invention is its provision of means for enhancing adhesion. For one thing, the surface 16 may be plasma treated to give a surface portion 20 which enhances adhesion several times. The treatment may be done in a chamber or reactor operating at a few torr of pressure of a suitable circulating plasma gas, such as air, oxygen, nitrogen, or helium, with radio frequency energy applied. Oxygen or air is especially effective as a plasma gas to remove films of grease or oil or other organic residue, with the resulting oxidation products, such as carbon dioxide and water being removed. This may be followed by a helium plasma treatment, which is followed by a purge gas. For further information, reference is made to an article entitled "How to Obtain Strong Adhesive Bonds via Plasma

Treatment" by Richard L. Bersin in *Adhesives Age* for Mar. 1972. Such treatment can increase the bond strength of plastics in the order of ten times what it would be otherwise.

Furthermore, the onlay may be pierced by through openings 21 (FIGS. 1 and 3) or by blind openings or recesses 22 (FIG. 11) and either of these may be either round, square, or any other shape, extending from the base surface 16 of the onlay 15. These openings 21 and 22 aid in the retention of cement 23 and to assist in obtaining a strong bonding force between the onlay 15 and the tooth 17. The openings 21 and 22 always communicate with the base side 16 of the onlay 15, whether they go all the way through or not. This is an important feature of the invention and it applies to other kinds of onlays 15 that are to be cemented to a tooth. It applies, for example, to onlays used in connection with tooth straightening for retaining arch wires.

On the front side 18 of the onlay 15, the side which is opposite to the base surface 16, a suitable means for attachment of a ligature is provided. This may be a plastic loop 25 integral with the onlay 15, or it may comprise a metal member 26 (see FIG. 11) with two members 27 going through the onlay 15, each having a grommet 28 or washer on their opposite side, or formed otherwise into such a shape that they cannot be withdrawn by application of strong pull.

FIG. 4 illustrates what the prior art did, and shows some of its bad features. The entire tooth 17 was exposed, or substantially the entire tooth, and this meant cutting away a substantial amount of tissue and bone 30, making the large hole 31. The bone in particular would almost never regrow, and sometimes adjacent teeth were considerably weakened.

FIG. 6 illustrates in contrast how the present invention works. A very small window 32 is cut through the tissue and bone 30 and then, once a small portion of the tooth 17 has been exposed, the onlay 15 is cemented to it and a ligature 33 affixed thereto and tied to an arch wire 34. As FIG. 8 shows, the traction exerted through the ligature 33 and arch wire 34 eventually helps the tooth 17 work its way down, and eventually it not only erupts, as shown in FIG. 8, but can be urged to its normal position by conventional braces or bands and brackets with an arch wire.

Sometimes (see FIGS. 7 and 9) it is more convenient to secure a modified form of onlay 35 to the back surface of the tooth 17. Such an onlay 35 has a different shape as shown in FIG. 9, but again it is a standard shape for almost all teeth. Otherwise structure and adhesion are the same, and again there is an anchor ring 36, only on the lingual side of the tooth 17 instead of on the labial side.

Sometimes a cap-shaped onlay 40 (FIG. 10) is the most convenient. Here, a smaller lower portion of the tooth 17 may be used, but both surfaces are covered, as well as the bottom edge, and the onlay 40 has a lingual side 41 and a labial side 42 with respective rings or anchors 43 and 44. Usually only one of these will be used, and the other one will be cut off by the orthodontist. Except for shape, the basic structure is the same.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the de-

scription herein are purely illustrative and are not intended to be in any sense limiting.

I claim:

1. An orthodontic onlay adapted to be cemented to an impacted tooth to aid in exerting corrective traction thereon, comprising

a curved base surface having a curvature essentially the same as that of a lower portion of such a tooth and having a lower edge of a configuration that conforms essentially to the profile of the lower edge of the tooth,

a series of openings leading from said surface toward the opposite surface, for receiving and holding cement and thereby increasing the bond between the tooth and the onlay when cement is placed thereon and

an anchor means consisting of a single closed loop on said opposite surface for attaching a ligature thereto, whereby the anchor means may be attached to an exposed portion of an impacted tooth, a ligature may be attached to said loop and corrective forces applied to the impacted tooth.

2. The onlay of claim 1 wherein said base surface corresponds in shape and size to the lower front surface of the tooth.

3. The onlay of claim 1 wherein said base surface corresponds in shape and size to the lower rear surface of the tooth.

4. The onlay of claim 1 which is cap shaped and is shaped and sized to inclose both front, rear, and bottom edge surfaces of the tooth.

5. The onlay of claim 1 wherein said anchor means comprises an integral plastic ring.

6. The onlay of claim 1 wherein said anchor means comprises a separate metal member held to said onlay by grommets.

7. The onlay of claim 1 wherein said onlay is plastic and is substantially the color of the tooth.

8. The onlay of claim 7 wherein said base surface is a surface that has been plasma treated to enhance adhesion.

9. The onlay of claim 1 wherein said openings go all the way through the bracket.

10. The onlay of claim 1 wherein said openings extend only part way through the bracket.

11. The process of exerting corrective traction on an impacted tooth comprising

a. exposing a small area of the lower portion of said impacted tooth;

b. cementing to said exposed portion an orthodontic onlay having a base surface with openings leading from said surface toward the opposite surface and anchor means on said opposite surface for attaching a ligature thereto; and

c. attaching a ligature to said anchor means and applying tension to said ligature whereby said impacted tooth is caused to move toward an erupted position.

12. The process of claim 11 wherein said onlay is made from tooth-colored plastic.

13. The process of claim 12 wherein said onlay base surface is a plasma pretreated surface.

14. The process of claim 12 wherein said anchor means is integral with the onlay plastic.

15. The process of claim 12 wherein said anchor means is metal secured to the plastic.

16. The process of claim 11 wherein said onlay openings go all the way through the onlay.

17. The process of claim 11 wherein said onlay openings are blind recesses.

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