United States Patent [19]

Millet

[11] **3,808,687**

[45] **May 7, 1974**

[54] **METHOD OF MAKING DENTAL RESTORATIONS AND PONTIC MEMBER THEREFOR**

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[52] **U.S. Cl.** **32/2**

[51] **Int. Cl.** **A61c 13/00**

[58] **Field of Search** 32/8, 2; 264/19

[56] **References Cited**

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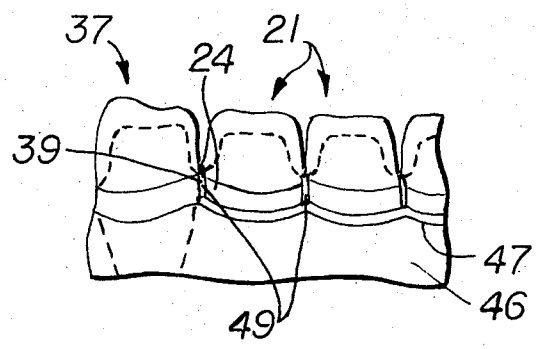
Primary Examiner—Robert Peshock
Attorney, Agent, or Firm—Julian Caplan

[57] **ABSTRACT**

A pontic has a rigid core and a detachable flexible plastic cap of 1 to 2.5 mm wall thickness having the external contour of a tooth. The core extends laterally slightly above the gum line to either side and has an exposed, flat, vertical face which may be secured to a matching face of an adjacent pontic or to a similar face of an insert attached to a wax or plastic coping or a wax or plastic crown which is, in turn, attached to the abutment die. In use, the abutments in a die are waxed in crowns, or copings, as per ordinary practice except for the above-mentioned inserts fixed to the abutment coping or crowns. Carding wax is applied to the tissue area of the model, and the pontics with caps in place are stuck to the wax, forming an indentation, matrix or index. Articulation is checked. The faces of the lateral extensions of the pontic cores are cemented to the adjacent abutment inserts or crown or copings extensions. Caps are then removed. The cores and abutment inserts are then invested as per the lost wax technique and metal cast into the mould cavity of the investment, also as per lost wax technique. The metal is porcelainized as in ordinary practice.

6 Claims, 17 Drawing Figures



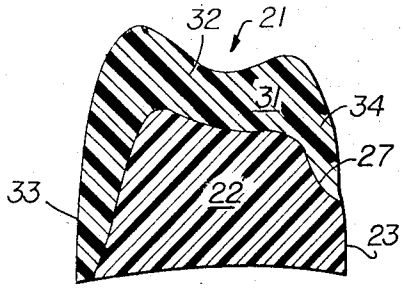


Fig. 2

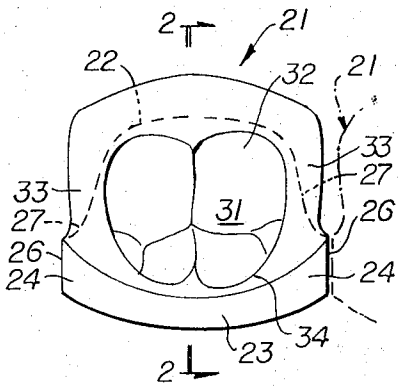


Fig. 1

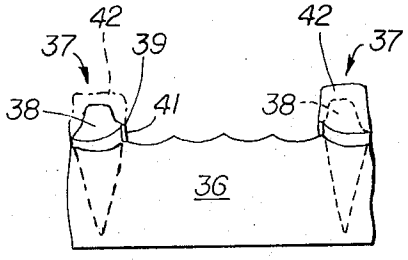


Fig. 5

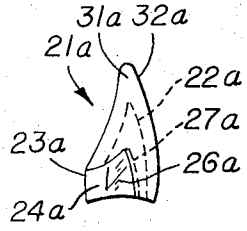


Fig. 3

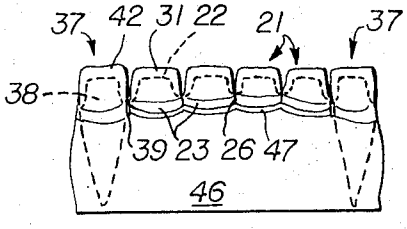


Fig. 6

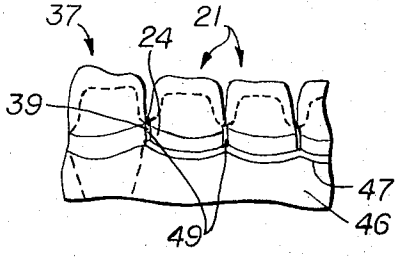


Fig. 7

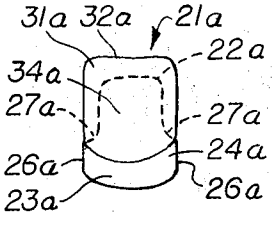


Fig. 4

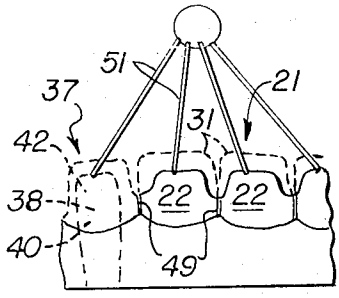


Fig. 8

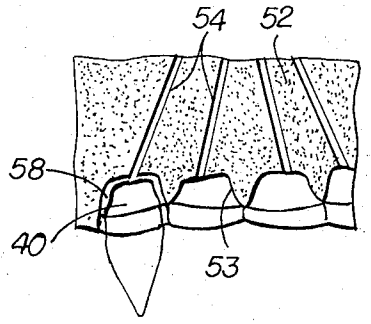


Fig. 9

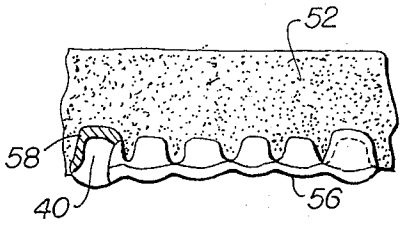


Fig. 10

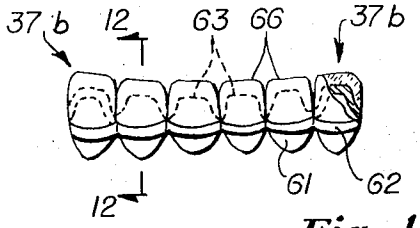


Fig. 11

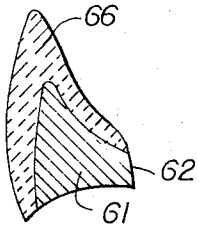


Fig. 12

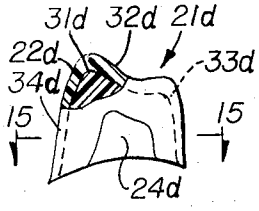


Fig. 14

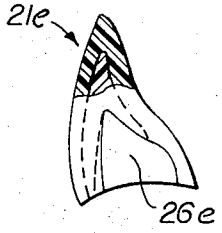


Fig. 16

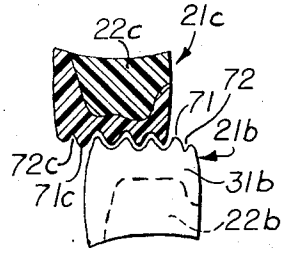


Fig. 13

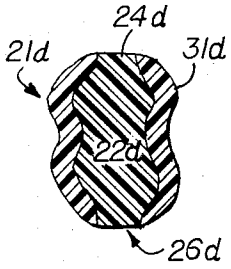


Fig. 15

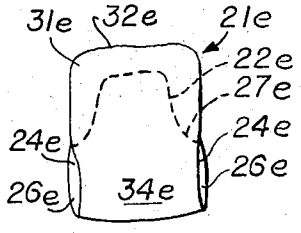


Fig. 17

METHOD OF MAKING DENTAL RESTORATIONS AND PONTIC MEMBER THEREFOR

This invention relates to a method of making dental restorations and also to a pontic member used in practicing the method. It is a principal object of the present invention to provide pontic members formed of a hard core of the shape which the metal part of the restoration occupies; and further, provided with a cap of a softer and more flexible plastic which acts as a guide when positioning the pontic and which represents the porcelain which is subsequently applied to the metal. The flexible cap is removable from the hard core.

In accordance with conventional practice, a considerable amount of time is required in applying wax to a pontic so that the waxed pontic has a reduced shape as compared with the completed tooth in the restoration. The present invention eliminates the need of waxing the reduced pontic and this greatly reduces the time required in making the model for the metal casting.

Another advantage of the invention is the fact that waxing of the reduced pontics is a technique which requires skill. Since the operation is eliminated in accordance with the present invention, the required skill of the technician is greatly reduced; and since the time is also reduced, the cost of preparing the model for investment is correspondingly reduced.

Still another advantage of the invention is the fact that the removable plastic caps are of uniform thickness and represent by that thickness the recommended correct thickness of the porcelain which is subsequently applied to the metal frame. Many of the failures in producing adequate restorations are attributable to the fact that the technician applying the porcelain does not understand, the intention of the technician preparing the model for investment and the thickness of the porcelain is not applied properly. The present invention eliminates the likelihood of such confusion.

Other objects of the present invention will become more apparent upon reading the following specification and referring to the accompanying drawings in which similar characters of reference represent corresponding parts in each of the several views.

In the drawings:

FIG. 1 is a top, or occlusal, plan of a molar pontic in accordance with the present invention.

FIG. 2 is a vertical sectional view taken substantially along the line 2—2 of FIG. 1.

FIG. 3 is a side elevational view of an incisor pontic in accordance with the present invention.

FIG. 4 is a front elevational view of the pontic of FIG. 3 viewed from the lingual side.

FIG. 5 is a schematic elevational view from the lingual side of a die for a bridge restoration showing preliminary steps in the formation of the practice of the method of the present invention.

FIG. 6 is a view similar to FIG. 5 showing the addition of four pontics in accordance with the present invention to the abutments of FIG. 5.

FIG. 7 is a fragmentary view of the structure of FIG. 6 showing cementing of the pontics to an abutment and also to each other.

FIG. 8 shows the removal of the caps from the pontics and the attachment of sprue formers to the structure of FIG. 7.

FIG. 9 shows an investment made from the model of FIG. 8.

FIG. 10 shows the metal casting made from the investment of FIG. 9 while still in the investment.

FIG. 11 is a rear elevational view showing a restoration formed in accordance with the present invention viewed from the lingual side.

FIG. 12 is an enlarged sectional view through one of the teeth of FIG. 11 take substantially along the line 12—12 of FIG. 11.

FIG. 13 is a view similar to FIG. 2 of a modification.

FIG. 14 is an elevational view from the lingual side showing a modification of the structure of FIG. 2.

FIG. 15 is a sectional view taken substantially along line 15—15 of FIG. 14.

FIG. 16 is a view similar to FIG. 3 of a modification.

FIG. 17 is a view similar to FIG. 4 of the modification of FIG. 16.

Pontics in accordance with the present invention are shown in FIGS. 1–4 inclusive. The pontic 21 of FIGS. 1 and 2 is for a molar and the pontic 21*a* of FIGS. 3 and 4 for an incisor, but the present invention is adaptable to the various positions in the dental art. In the center of the pontic 21 or 21*a* is a core 22 formed of a plastic material such as an acrylic, lucite, plexiglass or some other hard material. Generally speaking, the size of core 22 is such that there is a wall thickness of 1 to 2.5 mm between the core and the outline of the tooth which the core represents. The exceptions to this wall thickness are the formation of a lingual extension 23 extending immediately above the gum line and into proximal lateral extensions 24 on either side. The extensions 23, 24 represent in practical effect the exposure of metal in the completed restoration, and the difference between the exterior of the core 22 and the ultimate wall thickness of the tooth represents the porcelain which is applied to the metal portion of the restoration after casting. Each lateral extension 24 is formed with an exposed, vertical, flat face 26 for the purpose of attachment of the pontic to adjacent pontics or abutments as hereinafter explained. Where the core 22 joins the extensions 23, 24 there are chamfers 27 to provide a smooth transition between the metal and the porcelain which is later applied.

Fitting tightly on core 22 but removable therefrom is cap 31 which is preferably formed of a flexible plastic such as polyethylene and has four desirable characteristics. One is that it is readily removable from the core when necessary in the performance of the method; second, it does not readily adhere to cement. The third characteristic is that cap 31 acts as a guide with which to correctly position the cores on the dental arch. The fourth characteristic is that the wall thickness of cap 31 correctly represents the thickness of porcelain which is eventually applied to the metal casting. The crown 32 of the pontic 21 of FIGS. 1 and 2 has the exterior configuration of a molar (but see FIG. 13), whereas the crown 32*a* of pontic 21a of FIGS. 3 and 4 has the straight edge of an incisor. For other teeth, the crown 32 has a corresponding proper external shape. The labial surface 33 of the cap extends down to the bottom of the pontic, whereas the lingual surface 34*a* extends down only to the upper edge of lingual extension 23 of core 22. The wall thickness of the cap 32, as has previously been mentioned, is quite thin being about 1 to 2.5

mm. The pontic **21** or **21***a* is manufactured in various shapes depending upon the location of the tooth. In addition to these fundamental shapes, the pontics are provided in different widths and in different lengths to accommodate the natural tooth size of the patient. The mesial, distal and bottom, or tissue bearing, surfaces can be relieved or ground away to slightly alter the shape of the pontic, as is standard procedure when assembling artificial teeth. In forming the restoration, the technician selects the appropriate width and length of pontics which conform to the shape of the natural teeth of the patient.

In the practice of the invention, the dentist prepares abutment teeth in the mouth of the patient by reduction in accordance with conventional practice. An impression of at least one jaw is made using standard impression materials. Usually both the upper and lower jaw impressions are obtained. The correct bite is established by the use of a wax sheet. Thus from the standpoint of the dentist, practice of the present invention requires no alteration of conventional practices, and the dentist himself need acquire no new techniques.

At the laboratory, the first step is to cast "stone" (plaster) models from the impressions provided by the dentist, and these models are articulated in a standard articulator. The particular area where the restoration is to be constructed is then sliced from one of the models to form a model or cast **36** in accordance with standard techniques.

A model or cast **36** usually has two abutment dies **37** (see FIG. **5**) which correspond to the reduced abutment teeth left in the mouth by the dentist and these abutment dies are detachable from the model. The technician then applies wax. The crown or coping **38** corresponds to the shape of the abutment tooth which has been reduced by the dentist at the time that the impression was made of the patient's mouth. The crown or coping **38** will ultimately in the metal portion of the restoration comprise a socket or coping which fits over the abutment tooth in the mouth of the patient. The technician applies to the identulous side of the crown or coping **38** at the gum line an insert **39** of the same type of plastic as is used for the core **22**, and this insert **39** has an exposed, vertical flat face **41** corresponding in shape to the flat face **26** and located so that when a pontic **21** is inserted next to the abutment die **37** the faces **41** and **26** will abut and can be cemented together. The general shape of insert **39** is optional but can best be a circular cross-section piece which is temporarily held relative to crown or coping **38** by wax or cemented to the coping if the coping is made of plastic. The technician then adds inlay wax **42** to the crown **38**, building up the thickness of wax **42** sufficiently so that the metal frame which will ultimately be represented by the wax is thick and strong enough to make a good support for the porcelain which is ultimately applied to the exterior of the metal. The configuration of the wax **42** after it is fully applied is smaller than the ultimate porcelainized crown which will fit onto the abutment tooth. In other words, the exterior of the wax **42** is only sufficient to represent the exterior of the metal portion of the abutment of the restoration. The abutment die **37** is similar to any other restoration abutment die except for the use of the insert **39** having the flat face **41**. In FIG. **5** there are abutments on either side, the one on the left showing in dotted lines the ultimate shape of the wax and the one on the right showing the wax applied.

The technician then applies carding wax **47** to the tissue area **46** of the model **36**, the wax being about 1 to 2 mm thick. If the metal of the restoration is to be tissue bearing, then excess wax is trimmed away and the wax **47** lifted off the model with the core. If the metal of the restoration is to be porcelainized at the tissue area, the wax **47** is left behind on the model. The technician then selects pontics **21** constructed in accordance with this invention of the proper general shape and size as has heretofore been explained. These pontics are then stuck in place on the carding wax **47**, the left-hand pontic **21** being close to the abutment die **37** with the surface **26** of the pontic and the surface **41** of the abutment in close proximity. The other pontics are similarly placed, the right-hand pontic **21** having the same relationship to the right-hand abutment die **37** as on the left-hand side. The pontics **21** stick to the wax **47** sufficiently to enable the technician to check the articulation of the die by inserting in the original model and then inserting the models of the two jaws in an articulator and making sure that the bite is proper. Any adjustments that are necessary are performed as the type of wax **47** remains pliable and also serves as a matrix or index.

After the articulation is as desired, the technician starts with the left-hand pontic **21** (or the right-hand pontic if desired), removing it from the wax **47**, placing a drop of cement such as lucite and acetone cement on surface **26** and replacing the pontic **21** so that the cement **49** causes the adjoining surfaces **41** and **26** to permanently stick together. After the cement **49** has hardened, the next pontic **21** is removed from the wax **47**, cement applied to its left surface **26** and the pontic is then replaced on the wax so that the surfaces **26** of the two pontics are cemented together. This operation is repeated until the right-hand pontic **21** is cemented to the insert **39** of the right-hand abutment die **37**.

After all of the pontics have been cemented in place, the cap **31** of each pontic **21** is removed. Removal of the caps is facilitated by reason of their flexibility and the fact that they are of a material which does not readily adhere to the cement **49**. The completion of this operation is shown in FIG. **8** where the dotted lines represent the outlines of the original caps. Sprueforming material **51** is then waxed on to the cores **22** as well as to the wax **42** of each abutment **37**.

An investment is then made from the model and this is shown in FIG. **9** wherein there is a cavity **53** formed in the investment material **52** which represents the core **22** of the pontic. There are sprues **54** for the proper casting and venting of the ultimate metal casting which correspond to the sprues **51** and are all in accordance with conventional practice. With respect to the abutment, there is a hollow **40** which represents the core or abutment die **38** and a cavity **58** which is filled with wax or plastic and represents a crown or coping which was molded over the abutment die. The section **40** remains in the investment to provide the cavity **58** which is later to be filled with metal.

A metal casting of gold or other suitable material is made from the investment mold of FIG. **9**, and this is shown in FIG. **10**. The metal of the sprues **57** is cut away and discarded. There is thus formed a metal frame **51** having exposed connecting portion **62** joining one tooth to the other, and this is preferably on the lin-

gual side of the restoration. There is a plurality of metal teeth **63** each slightly reduced as compared with the eventual tooth of the restoration.

In accordance with conventional practice, porcelain **66** is applied to the metal frame **61** concealing the metal teeth **63** in all areas except the exposed connecting portion **62.** The abutment crowns or copings **37***b* are hollow, the hollows corresponding in shape to the abutment teeth which have been left by the dentist in the mouth of the patient. In applying the porcelain **66,** the porcelain technician uses approximately the same thickness as the wall thickness of the cap **31** of the pontics **21.**

FIG. **13** is a modification of the structure of FIG. **2** and many of the elements are substantially the same as in FIG. **2.** Those elements appearing in the lower jaw are indicated by the same reference numerals as in FIG. **2** followed by the subscript *b* and those in the upper jaw are designated by the same reference numerals followed by subscript *c*. The pontic **21***b* has a core **22***b* similar to that of FIG. **2.** However, the cap **31***b* is formed with a top **71** having a plurality of lateral locating grooves **72.** This form of top **71** is less expensive to mold than that shown in FIGS. **1** and **2**; and furthermore, the same mold may be used for uppers and lowers; and generally speaking, the same mold may be used for a plurality of different bicuspids and molars. The upper die, which matches the lower die, may be made from the impression of the actual teeth of the patient. However, in FIG. **13** the pontic **21***c* is provided to indicate that there is a restoration of the upper and the lower jaws. Core **22***c* is similar to core **22***b* and the top face **71***c* is similar to face **71** and the grooves **72***c* are similar to grooves **72.** The grooves **72, 72***c* are fit together in an articulation machine to provide the proper bite for the patient's mouth. This may be varied by interfitting different grooves **72** with different grooves **72***c*. In other words, the pontic **21***c* may be moved to the left or right as viewed in FIG. **13** to accomplish the proper articulation. The same left or right movement may be accomplished where the pontic **71***c* is replaced by a die that actually conforms to the natural tooth of the patient.

In other respects the pontics **71***b* and *c* resemble those of preceding modifications and the same reference numerals followed by subscripts *b* and *c* are used to designate corresponding parts.

It is sometimes desirable to completely cover with porcellain the metal frame of abutment copings and adentulous pontics. This construction is also possible using the present invention.

Directing attention to FIGS. **14** and **15,** extension **23** is eliminated from the core of pontic **21***d*. The lateral extensions **24** with their opposed flat faces **26***d* are used (as in FIGS. **1** and **2**). Directing attention to FIGS. **16** and **17,** only the interproximal lateral extensions **24***e* having flat faces **26***e* are used and the lingual extension **23***a* of FIGS. **3** and **4** is eliminated. In other respects, the structures of FIGS. **14–15** and FIGS. **16–17** resemble those of FIGS. **1–2** and **3–4** and the same reference numerals followed by subscripts *d* and *e* respectively are used to designate corresponding parts.

What is claimed is:

1. A pontic for dental restorations comprising a substantially rigid core shaped substantially the same as the metal portion of the restoration to be formed and having on either side an inter-proximal lateral extension terminating in a face shaped for joining to a cooperating face of an adjacent pontic and a flexible plastic cap fitting over said core and formed of a material such that said cap can be detached from said core, said cap having an external configuration substantially the same as the porcelainized portion of the restoration to be formed, said cap having lower edges fitting against the top of said lateral extensions.

2. A pontic according to claim **1** in which said core is formed with a lingual extension at the tissue line merging with the lateral extensions at either side of said core.

3. A method of forming a pattern for the investment mold of a dental restoration comprising forming a model from a portion of the impression made of a patient's jaw wherein there is at least one abutment reduction die, affixing to said die a laterally extending insert having an insert face, applying inlay wax to said abutment die to simulate the exterior configuration of the metal of the crown to be applied to the abutment reduction of the patient's tooth, applying at least one pontic of the type defined in claim **1** to said model with one of the faces of said pontic abutting said insert face, checking the articulation of the assembly of model, wax and pontic, and removing the cap from said pontic.

4. A method according to claim **3** which further comprises applying second wax to said model at the situs of said pontic prior to the step of applying the pontic and in which said step of applying said pontic initially comprises temporarily sticking said pontic to said second wax and which further comprises the step of cementing said one face of said pontic to said insert face after said step of checking the articulation of the assembly.

5. A method according to claim **3** which further comprises applying sprue forming material to said assembly.

6. A method according to claim **5** which further comprises applying investment material around said assembly and hardening said investment material to form an investment mold.

* * * * *