ABSTRACT OF THE DISCLOSURE
A precision dental attachment for use with periodontally involved teeth and for the replacement of missing teeth. The attachment includes a female threaded collar portion formed on or attached to a metal coping as used in procelain fused-to-metal dental restorations. The threaded collar portion on one coping is precisely positioned to align with a like female collar portion of an adjacent metal coping so that when the threaded collars are joined by a threaded stud they precisely position the copings whose axes are threadedly advanced on the common threaded stud to bring the collars into a contiguous relationship.

BACKGROUND OF THE INVENTION
Field of the invention
This invention pertains to the general class of Dentistry and in particular to those subclasses pertaining to “dentures, partial”; “dentures, fixed”; “dentures, lingual bars”; “teeth, permanently attachable”; “teeth, crowns”; and “orthodontic devices.” This invention may also pertain to the general class of Metal Founding and in particular to “processes”; and to “processes, dental.”

Description of the prior art
Fixed crown and bridge dentistry quite often use jacket crowns in which a metal coping is molded to fit one or more prepared clinical crowns. The advent of new techniques for the use of fixed crowns and bridges have also brought manufacturing problems. In particular, the crown and bridge dentistry using the process termed “procelain-fused-to-metal restorations” has shrinkage and warpage problems.

In the use of procelain in a restoration, the inherent properties of corrosion resistance, hardness and transparency are secured after firing of the porcelain. In the preparation of the “biscuit” from the fired procelain the “firing” is at temperatures such as sixteen hundred degrees. A “glazing” process at the final stages of manufacture may use temperatures of about nineteen hundred and fifty degrees Fahrenheit. porcelain particularly adapted for dental restorations and using substantially the above indicated temperatures may be secured from Ceramco, Inc., 31—16 Hunters Point Avenue, Long Island City, N.Y., 11101, or other supply houses. As a product of and as a result of this firing there is a high degree of contraction or shrinkage of the procelain, which strains are transmitted to the coping. This coping is usually a gold alloy or the like and having a high fusing temperature. This alloy fusing temperature is usually at least one hundred degrees above the maximum heat of firing the procelain so that the porcelain firing heat can distort and/or warp the metal coping. These distortional changes preclude the fitting of the copings upon the prepared clinical crowns. Many stresses and strains caused by the contraction of the porcelain in the firing or baking, when unrelied, may cause the porcelain to fracture or shear from the substructure during the additional stress of mastication of food.

Therefore, in order to splint together periodontally diseased teeth, or to use abutment teeth as anchors for the replacement of missing teeth, which abutment teeth are essential to bridge the missing teeth, the restoration techniques have been limited to using either solder joint connectors or a variety of precision attachments. The soldered joint attachment constitutes the casting of individual copings which are then soldered into a fixed bridge to create a single unit out of a multiplicity of units. This fixed single unit is checked upon the master model reproduction of the oral cavity and when a precision fit is confirmed, it has been customary to apply the porcelain frit to the metal coping and fire the porcelain and coping.

In the design of these dental restorations a metal framework or substructure is created which consists of individual copings fitted to the patient’s remaining abutment prepared clinical crowns and sometimes with pontics designed to fill the spaces of the missing teeth. Often these substructures are joined together in a precision manner by solder joints. These joined copings are caused to and must fit in a very precise manner upon the master model or index to insure a perfect fit of the framework on the patient’s prepared clinical crowns. Although the index and the soldered substructure may be a perfect fit before firing, once porcelain is fused to the metal framework the resulting distortion and shrinkage caused by the contraction of the porcelain can alter the substructure assembly. The many changes which take place in the metal often render the fit of the framework to the patient’s mouth inaccurate or impossible.

Even where the contraction and shrinkage of the restoration is controlled to the extent that distortional changes are minimized, when a large prosthetic restoration is prescribed it is possible that framework breakage damage may ensue due to a variety of reasons. This damage then requires the discarding of the entire soldered restoration.

There have been many attempts to provide a method whereby the difficulty of forming satisfactory porcelain-fused-to-metal bridges or restorations is minimized. This also includes the breakage of the porcelain fused to the metal framework. Among these improvement attempts are those of fixed partial dentures, in which individual portions are constructed and assembled. These individual restorations include many types of attachments, several which have been described in U.S. patents.

Typical of these patents is a patent proposing a method for the connection of crowns which is shown in U.S. Patent 3,083,461 to Hirschhorn of Apr. 22, 1963. U.S. Patent 2,660,789 to Roscato of Dec. 1, 1951 also shows a method of joining restorations; however, this method provides for a resilient anchorage for a removable tooth. A dental bridge is shown in both U.S. Patent 1,921,613 to Freedman of Aug. 8, 1933 and in U.S. Patent 3,091,032 to Hirschhorn of May 28, 1963. A stationary bridgework is shown in U.S. Patent 2,703,366 to Van Dyk of Apr. 5, 1955.

Therefore, in order to splint together periodontally diseased teeth or abutment teeth which are essential to bridge the gaps caused by one or more missing teeth, the techniques have been limited to using either solder joint connections or a variety of precision attachments such as those above-identified. The soldered joint splint constitutes a creation of a single unit out of a multiplicity of units prior to firing the porcelain. The known precision attachments for joining individual restorations do not provide the rigidity found in the fixed metal framework with the porcelain fused thereto. Insofar as is known and as shown in the above-identified patents, there has not been prior to this invention a precision dental attachment which eliminates the use of a soldered joint while providing a precise rigid contiguous joining of adjacent restorations. My invention provides for the individual form—
ing of copings; locally fusing porcelain to these copings to provide individual restorations, and the joining of two or more individual restorations to at least two prepared clinical crowns with or without intermediate pontics. These jacket crowns and/or pontics after being individually finished are adapted for joining together in a fixed alignment prior to the insertion of the restoration to the prepared abutment teeth.

SUMMARY OF THE INVENTION

The dental restoration attachment to be shown and more fully described hereinafter contemplates that an alloy coping is formed with or has soldered to it a threaded collar portion generally normal to the principal axis of the coping. This collar portion is precisely positioned to align with and contiguously engage a like collar portion on an adjacent coping. The mating collars are so arranged that when brought into face-to-face engagement the threaded portions mate to form a continuously threaded passageway adapted to snugly receive and retain a threaded stud of determined length. The copings are cast in the usual manner and each is adapted to seat upon a prepared clinical crown. Where the restoration includes a pontic, the metal dummy or substructure is shaped to suit the particular void. The metal dummy preferably has one side soldered to a coping so that the pontile does not turn. The dummy and an adjacent coping can be cast as a single unit if desired. Where the precision attachment of this invention is to be used, one or more threaded collar portions are provided on each coping with the collar portions attached so that when joined into an assembly the substructure thus formed precisely fits the index or reproduction of the oral cavity. The copings are then locally coated with porcelain frit and fired as a biscuit. The porcelain is then shaped, checked and glazed by firing, after which the restorations are assembled and checked on an index or master model of the mouth.

The new concept in fixed crown and bridge dentistry as provided by this invention may be utilized in any crown and bridge technique from full-cast gold crowns, veneer crowns, to the highly aesthetic porcelain-fused-to-alloy gold restorations. This new concept in the porcelain-fused-to-metal restoration permits the firing of the porcelain to the metal coping in as many smaller units as is prescribed by the case, or as found desirable insofar as the crown technician is concerned. All are easily joined together after the individual units are finished and glazed prior to the insertion and cementation of the restoration assembly in the patient's mouth.

The advantages of this invention in dental restorations include the elimination of solder joints and permit the firing of individual restorations or splints in a periodontally involved case. The shrinkage and contraction stresses caused by firing are limited to each restoration unit and eliminates the accumulation of distortion found in soldered substructures. This invention permits ideal interproximal contour and design compatible with the contiguous soft tissue and aesthetic requirements of the patient.

Restoration assemblies made according to the teachings of this invention have the same fixed immovable qualities of a soldered joint assembly restoration after insertion in the mouth. The threaded attachment portions are practically indestructible, not prone to wear, do not permit drifting, nor shifting or settling of the restoration as it is carried by the abutment teeth.

As reduced to practice, the attachments are made in a variety of sizes so that the dentist and technician can select the之一 basis of need, strength and position that size which is best suited for anterior or posterior restorations. The attachments are invisible once the restoration is inserted, yet it can be easily cut should the occasion arise, thereby so allowing redesign or addition of a segment, without destroying the entire restoration. This attachment provides means for future removal and design changes to be made when such becomes necessary due to the normal atrophic changes in the mouth.

When large span restorations are essential to the success of the case and where multiple abutments are utilized, the soldered restoration often encounters a binding between the metal copings and the abutment teeth prepared clinical crowns. Such binding may necessitate the cutting, destroying or redoing of a large and costly prosthetic appliance. The restorations of this invention can be tried in the mouth, first as individual units, then as segments joined together progressively. A temporary mounting in the mouth for one or two days is often used to check the success and comfort of the fit prior to final cementation of the restoration in the mouth.

INTENT OF THE DISCLOSURE

Although the following disclosure offered for public dissemination is detailed to insure adequacy and aid in understanding of the invention, this is not intended to prejudice that purpose of a patent which is to cover each new inventive concept wherein no matter how it may later be disguised by variations in form or additions of further improvements. The claims at the end hereof are intended as the chief aid toward this purpose, as it is these claims that meet the requirement of pointing out the parts, improvements, combinations or methods in which the inventive concepts are found.

A specific embodiment of the dental precision attachment has been chosen for the purposes of illustration and description and two methods of forming and using the attachment are shown, the embodiment and methods are shown in the accompanying drawings forming a part of the specification wherein:

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 represents in a slightly enlarged view a side view of a restoration having a plurality of members with a portion of two jacket crowns broken away to show an internal arrangement of an attachment assembled in accordance with this invention;

FIG. 2 represents in a partly diagrammatic side view and on a reduced scale the arrangement of a typical dental restoration in which three jacket crowns and a pontile are adapted for mounting upon and to prepare clinical crowns as well as filling a missing tooth space portion;

FIG. 3 represents in a reduced scale a sectional view showing an assembly of adjacent jacket crowns prior to their mounting upon prepared clinical crowns;

FIG. 4 represents in a partly sectional view a grouping of the metal components providing one precision attachment of this invention;

FIG. 5 represents a sectional view wherein is seen a threaded collar attached to a metal coping;

FIG. 6 represents two adjacent plastic patterns with a two-piece plastic threaded collar joining the two plastic patterns;

FIG. 7 represents a sectional view showing the two-piece plastic collar of FIG. 6 as maintained in alignment by means of a hinge and in a molding position;

FIG. 8 represents a plan view looking downwardly on the two-piece plastic collar, the view taken on the line 8--8 of FIG. 7, and

FIG. 9 represents a sectional view of the two-piece plastic collar swung into an end-to-end relationship and alignment prior to the halves being trimmed for attachment to the plastic patterns of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in particular to the drawing wherein like numbers refer to like members throughout the several figures and in particular to FIGS. 1 through 5, wherein as shown in FIG. 1, adjacent jacket crowns 10 and 11 are joined as a part of a dental restoration to be more fully described below. As here shown, each jacket crown
is typically contemplated to be a porcelain-fused-to-metal restoration assembly in which metal copings 12 and 14 are cast from appropriately formed molds so as to have the interior portion of the copings 12 and 14 mate with the prepared clinical crowns 16 and 17 which have been previously fabricated as by grinding. Each coping is to be joined by this invention has attached to it at least one threaded collar. The collar 19 is shown on coping 12 while collar 20 is shown on coping 14. The collars 19 and 20 are provided with identically sized internal threads and are aligned so that when a threaded stud 22 is mounted there-in the collars are precisely aligned and are manipulated so as to be brought into an assembled condition with their outer faces in a contiguous relationship.

As seen in FIG. 2, it is to be noted that jacket crowns 10 and 11 may be assembled to be a portion of a bridge and are adapted to fit upon prepared clinical crowns 16 and 17. Also representative of the arrangements wherein this invention is used in dental restorations is the assembly of FIG. 2 which includes a pontic 24 and a jacket crown 26 adapted to fit upon prepared clinical crown 28. The lower portion of this FIG. 2 is representative of a portion of an oral cavity wherein the prepared clinical crowns 16, 17 and 28 extend above the gingiva or gum 30, the prepared clinical crowns having been selectively shaped as above-described. This restoration is merely representative of the many assemblies that can be made, each assembly being a precise individual formation for the use of the particular patient.

Referring next to FIG. 3, a dental restoration is shown which is comprised of two jacket crowns adapted to repair two defective teeth. These jacket crowns may be the clinical crowns 16 in which the metal copings 12 and 14 are separable and aligned and joined by means of the threaded collars 19 and 20 and the stud 22 therein.

Referring next to FIG. 4, there is shown the members comprising a precision dental attachment for adjacent copings. The threaded collars 19 and 20 are of metal usually of an alloy like the coping and having a like fusing temperature. The collars are sized so that the outer ends of the collars may be trimmed and shaped to fit upon the appropriate coping. The stud 22 is of a length substantially equal to but less than the length of the two threaded collars after they have been shaped for attaching to respective copings.

As seen in FIG. 5, a coping represented as coping 14 has a threaded collar 20 whose attaching surface has been shaped to fit the coping 14 and by means of solder 31 the collar 20 is soldered to the coping 14. Adjacent copings are fitted to the master model before the soldering of the collars to the respective copings. The precise fitting of the collars to the copings is, of course, dependent upon the skill of the dental technician. However, in general practice, the preciseness of work required to use the precision attachment of this invention requires only a level of skill generally found in these dental technicians. The technique of attaching the threaded collars as by soldering will be described in the Use and Operation of this invention.

DESCRIPTION OF THE ALTERNATE EMBODIMENT

Referring now to FIGS. 6, 7, 8 and 9, it is to be noted that in the preparation of investment castings from which the copings are customarily made, that wax or plastic forms 40 and 41 are used in a very precise manner on a master model or index of the oral cavity. Between these forms 40 and 41 there is mounted a plastic collar form 42, which collar form is internally threaded. A parting line is formed in the collar and is adapted for separation of the plastic threaded collar at this precise parting line and without any loss of material. The threaded collar is fastened to the forms 40 and 41 and then at the parting line is separated to permit the investment casting of the form with the collar integral therewith, thus negating the necessity of soldering of a collar to the investment form substructure. The plastic collars 47 and 48 are placed in alignment on the master model in the "wax-up" of the various copings. After separation each coping model can be invested and cast in one piece with the collar integral, thereby simplifying and eliminating the above-described soldering steps.

A suggested technique for the manufacturing of the threaded collar is shown in FIGS. 7, 8 and 9 in which threaded halves 46 and 47 are molded of a determined length and size with the halves connected by means of a hinge 48. After the plastic piece has been molded, the two halves 46 and 47 are swung into the position of FIG. 9. In this position the hinge 48 maintains a precise alignment of the two halves and, when molded, the threads of the interior of each half is precisely oriented with the hinge so that the lead of the thread from half 46 precisely continues into the half 47. When the faces of the halves 46 and 47 are brought into a contiguous relationship with each other the threaded interior portion is a continuous thread. This arrangement is considered desirable in that it permits a separation of the halves 46 and 47 to be made by the cutting of only the outwardly extending hinge 48. The hinge, when cut, causes no removal of the material in the threaded collar portions so that the thread continuation from half 46 to 47 is maintained. This thread continuation is highly important so that when the stud is inserted the precise joining relationship of the two halves may be maintained.

USE AND OPERATION

In the design of the dental restorations for which the precision dental attachment of this invention is particularly pertinent, it is to be noted that these restorations are considered permanent. However, if damage is caused to one of the jacket crowns on to a pontic it requires only that this cemented bridge or dental restoration be removed from the prepared clinical crowns. After removal, the damaged jacket crown or pontic may be replaced without the destruction of the complete dental restoration. In like manner, additions to the original restoration can be made with a minimum of rework to the original restoration. The precision techniques now used in dental restoration is utilized in this invention in that the master model or index of the oral cavity is prepared in the customary way. The precise relationship of the oral cavity and the prepared clinical crowns thereon as represented by the master model or index is used so that the pontics and jacket crowns may be properly shaped and checked as to a precise fit prior to their insertion in the patient's mouth.

Forms for the metal copings are prepared in the customary manner when the soldering of threaded collars of the precision attachment is to be made to the copings. The copings are cast and fitted to the master model or index, then a pair of threaded collars of a selected size are assembled on a stud 22 and the collars of the attachment are brought into a tight contiguous relationship to each other. The outer ends of the collars, such as collars 19 and 20, are ground and shaped to fit precisely between adjacent copings as in the manner of copings 12 and 14 in FIG. 3. When the desired fit has been made, the collars are soldered to the copings and the fit of the assembled copings to the master model is checked and may be altered until it is determined that the desired fitting is provided. The copings are manipulated so that when the two collars are brought into precise contiguous relationship on the stud 22, the copings precisely fit on the master model.

It is to be noted, of course, that the copings are rotated in respect to each other so as to screw and unscrew the collars from the stud. This rotation permits a small amount of rocking in the restoration to be made when necessary to fit the copings to the prepared clinical crowns. Although, as shown in FIG. 3, there are only two copings joined by the precision attachment of the two halves it is readily apparent and is often required that a plurality of attachments be used. This is necessary when a dental restoration is a large span utilizing multiple abutments and/
or multiple jacket crowns for restorations such as a round house; i.e., a fourteen unit splint. In a molar-to-molar re-
struction or smaller, the restoration may be designed so that the attachment of adjacent copings to each other is accomplished in combination with precision attachment of these individual crowns. On occasion, two copings may be soldered together and this substructure may be joined to adjacent substructures or copings by the precision attachment of this invention. Where the restoration includes a pontic, the dummy is soldered or otherwise immovably attached to at least one adjacent jacket crown. The other side of the dummy may have a collar attached for joining the dummy to the ad-
jacent jacket crown.

Where the threaded collars are to be cast as a part of the coping, the technique shown in FIGS. 6 through 9 is used. The "wax-up" of the plastic forms such as 49 and 41 are mounted upon the master model and to these forms the trimmed plastic collars 46 and 47 to the forms have been made, the bridge or hinge 48 is then severed so that each individual form may be removed from the master model. The investment slurty is then applied in the usual manner and the coping is cast in the usual man-
ner. If the threaded end of the plastic coping is maintained during the casting process by means of a form such as a solid threaded carbon rod. This carbon rod retains the shape and preciseness of the thread until after the metal coping is cooled and cleaned, at which time the threaded carbon rod is removed or destroyed. This is one suggested means for retaining the threaded formation of the collar portion during casting of the copings.

Upon the completion of the preparation of the copings and/or dummies with the threaded collars thereon, the copings, copings and collars or combination thereof either on the soldered-on collar or with the cast-on collar has the porcelain frit applied to it. The jacket crown or pontic is then fired at a high temperature. The porcelain now in its attached final condition is shaped and then glazed and the completed splint or bridge is checked on the master model. The adjacent restorations are joined by means of the threaded studs and as the adjacent jacket crowns and pontics are assembled they are checked upon this master model. It is, of course, apparent that any shrinkage or error in dimensions in the individual jacket crowns, crown and pontic and that no accumulated error of shrink-
age or distortion occurs. Small amounts of tolerances are usual in dental restorations and the present invention al-
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ship for mounting on prepared clinical crowns of the oral cavity, and (c) a threaded stud having a length longer than the threaded portion of one of a pair of adjacent collar portions, the threaded stud adapted to enter and be retained in each of the threaded collar portions and when so retained the stud maintains the substructures in a positive alignment and longitudinal movement.

2. In a precision dental attachment as in claim 1 in which the substructures, collars and stud are of metal alloy and in which the collars are attached to the substructures as by soldering.

3. In a precision dental attachment as in claim 2 in which the substructures and attached collars are adapted for local covering by porcelain frit and for the resulting assembly restoration members being adapted for firing at a relatively high temperature, and, after firing the porcelain, may be shaped and glazed to provide the desired restoration appearance and with the face of the collar substantially at the surface of the restoration member so that when adjacent restoration members are assembled by means of the threaded stud the stud is virtually concealed by the mating of the adjacent restoration members.

4. In a precision dental attachment as in claim 1 in which the substructure and collar are assembled as a form and then from said form an investment casting of alloy metal is made.

5. In a precision dental attachment as in claim 4 in which the collars for two adjacent substructures are made as threaded halves with each half of a determined length, said halves being connected at adjacent ends by means of a hinge adapted to permit said adjacent ends to be moved into a face-to-face relationship, and with the threads so positioned in each half and in relation to the hinge that when the hinged halves are brought into the face-to-face engagement the helix of the thread is continuous from one half to the next half.

6. In a precision dental attachment as in claim 5 in which the form and collars are of plastic and the like, the form and collars being consumed in the firing step in the preparation of an investment for an alloy metal investment casting reproduction of the form.

7. The method of forming a dental restoration assembly in which a precision dental attachment provides for the threadedly attaching of adjacent members to form a permanent bridge and the like which is fitted to prepared clinical crowns of at least two abutment teeth, the restoration adapted for cementing permanently onto said clinical crowns, the steps of preparing the restoration including:

(a) forming an alloy substructure such as a coping, dummy and the like;
(b) attaching a threaded collar portion to each of two adjoining substructures, the collar portions aligned so that when the substructures are in their to-be-mounted position, the collars are in axial alignment and when the mating faces of the collars are in a contiguous relationship the helix of the thread of one collar mates as a continuous helix with the thread of the adjacent collar;
(c) threadedly mounting a threaded stud of determined length in the adjacent collars, which stud length is less than the combined thread length of the mating collars, and
(d) rotating the adjacent substructures until the faces of the adjacent collars are brought into a contiguous relationship.

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