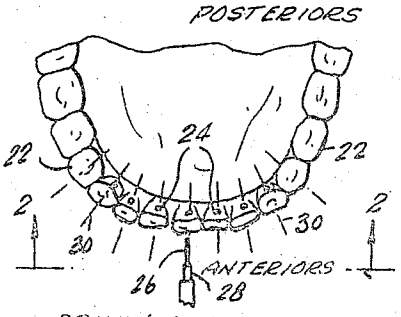
Oct. 24, 1967 B. WEISSMAN 3,348,311

METHOD OF SPLINTING TEETH

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FIG. 1



DRILL & CSK. TEETH

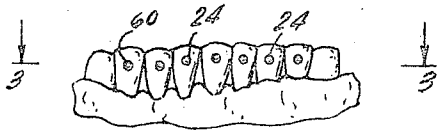
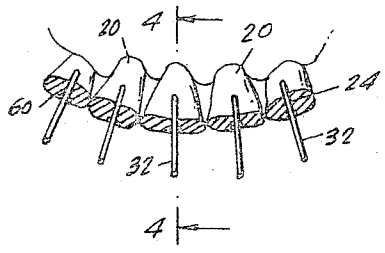


FIG. 2

FIG. 3



PINS INSERTED IN HOLES PREVIOUSLY DRILLED

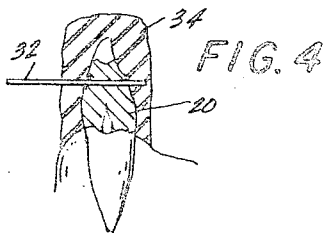


FIG. 4

IMPRESSION MADE & THEN PINS WITHDRAWN

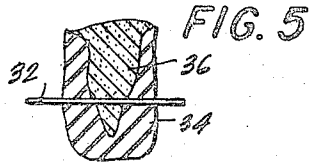


FIG. 5

IMPRESSION CAST WITH PINS REPLACED

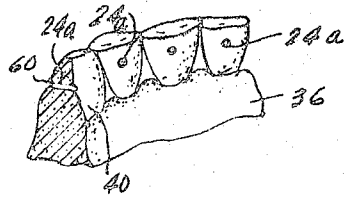


FIG. 6

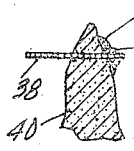


FIG. 7

NUT DRAWN UP TO LINGUALS OF CASTING ON THREADED PIN & WAXED IN PLACE

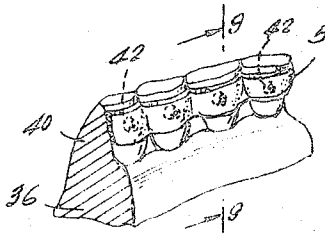


FIG. 8

LINGUALS OF CASTING COATED WITH WAX - METAL CASTING MADE CAUSING WAX BURN-OUT

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FIG. 9

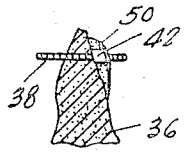


FIG. 9A

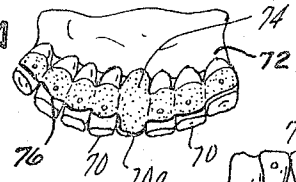


FIG. 9B

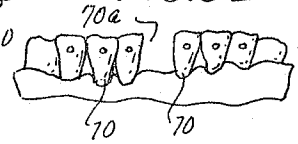
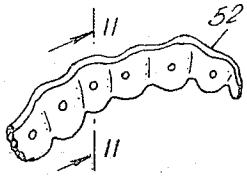


FIG. 10



SPLINT COMPLETED

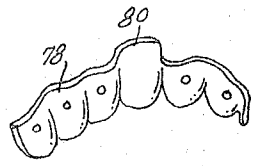


FIG. 10A

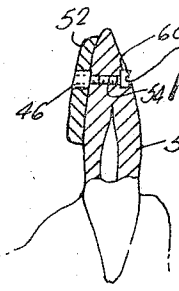


FIG. 13

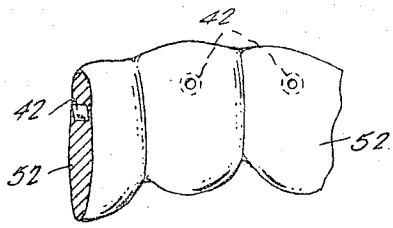


FIG. 11

FIG. 14

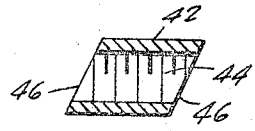
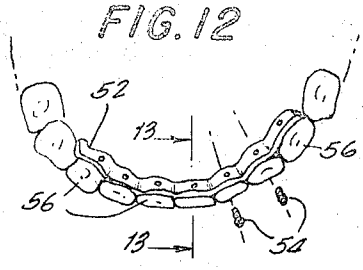


FIG. 12



SPLINT DRAWN UP TO TEETH WITH SCREWS

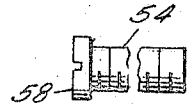


FIG. 15

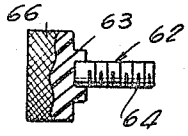


FIG. 16.

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3,348,311

METHOD OF SPLINTING TEETH

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Filed Aug. 6, 1963, Ser. No. 300,199
4 Claims. (Cl. 32—6)

This invention relates to a splint for the reinforcement and retention of teeth in the mouth and to a method for the fabrication of the same.

The practice of reinforcing natural teeth by means of a splint structure disposed along the lingual surfaces of anterior teeth is now recognized in the practice of dentistry. The methods for the formation of such splints and their application are however accompanied by serious limitations. Among the limitations in the current practice of the fabrication and application of splint structures is the requirement that securing pins for the splint structure formed integrally therewith must be disposed in horizontal parallelism. This requirement arises from the fact that the splint must be inserted from the lingual side and the fact that the securing pins which are intended to be inserted through perforations formed in the tooth body are formed integrally with the splint structure. As a consequence of this, it has been found to be impractical, if not impossible, to apply such splints to other than the anterior teeth. The requirement of horizontal parallelism in the securing pin portion of the splint has also made it necessary to utilize involved and complicated procedures in the preparation of the teeth and particularly in connection with the formation of the perforations which are adapted to receive the securing pins. As a consequence of this, special equipment has been developed and must be utilized in order to assure the requisite parallelism and the procedure from the point of view of the dentist has been involved and time consuming. The procedures involved are also the source of considerable discomfort to the patient.

It is therefore an object of this invention to provide a splint structure which may be readily secured to the lingual surfaces of the teeth desired to be reinforced and retained with a minimum amount of preparation and discomfort to the patient.

It is a further object of this invention to provide a procedure for the fabrication of splint structures of this type wherein the splint may be fabricated in a simple, efficient and economical manner with the requisite accuracy for acomplishing the desired ends.

Another object of this invention is to provide a splint structure which is adapted to be secured in position in the mouth by means of removable screws so as to eliminate the requirement of parallelism in the apertures formed in the teeth for receiving the screws or in the screws themselves. Temporary insertion is made possible for purposes of alignment of loose teeth or the like. The arrangement is such that the splint structure may extend over and include posterior as well as anterior teeth.

It is also an object of this invention to provide a splint structure and a method for the fabrication of the same whereby the splint structure may include support means for artificial teeth to be simultaneously inserted and positioned in the mouth.

It is also an object of this invention to provide a splint structure and a method for the fabrication of the same wherein a maximum amount of adjustment may be accomplished in the installation of the structure in the mouth with a minimum amount of discomfort to the patient.

Other and further objects, benefits and advantages of the instant invention will more clearly appear from the description contained in the specification and claims as well as from the appended drawings wherein:

FIGURE 1 is a plan view of the lower jaw showing the dentition of the mandible;

FIGURE 2 is a front elevational or facial view of the dentition shown in FIGURE 1 when viewed along line 2—2 of said figure;

FIGURE 3 is a fragmentary cross-sectional view taken along line 3—3 of FIGURE 2 and showing the locating pins in position;

FIGURE 4 is a cross-sectional view of a tooth surrounded by an impression material and showing a locating pin in position as viewed from line 4—4 of FIGURE 3;

FIGURE 5 is a cross-sectional view of the impression of a tooth such as shown in FIGURE 4 showing the cast investment model;

FIGURE 6 is a fragmentary view partly in cross-section showing the model cast from an impression such as taken in FIGURE 4 removed from the impression material;

FIGURE 7 is a cross-sectional view of one of the teeth of the model of FIGURE 6 showing a threaded pin and nut mounted upon a model casting;

FIGURE 8 is a fragmentary view partly in cross-section of a cast model showing the wax-up of the desired splint;

FIGURE 9 is a cross-sectional view of FIGURE 8 taken along the line 9—9 of FIGURE 8;

FIGURE 9A is a view of a wax-up of dentition as shown in FIGURE 9B wherein it is intended to install an artificial tooth in place of a missing natural tooth;

FIGURE 9B is a view similar to FIGURE 2 wherein one of the anterior teeth is missing and will be replaced by a splint supported artificial tooth;

FIGURE 10 is a perspective view of a metal splint after the casting operation;

FIGURE 10A is a perspective view of a resultant cast metal splint for the type of dentition shown in FIGURES 9A and 9B;

FIGURE 11 is an enlarged fragmentary view partly in section taken along line 11—11 of FIGURE 10;

FIGURE 12 is a view showing the installation of a cast metal splint in the mouth;

FIGURE 13 is a cross-sectional view taken along line 13—13 of FIGURE 12 on an enlarged scale;

FIGURE 14 is a cross-sectional view of the securing nut in enlarged scale;

FIGURE 15 is a side elevational view of a threaded pin or screw adapted to be received within the nut shown in FIGURE 14; and

FIGURE 16 is a view, partly in section of a modified form of retaining screw having a plastic or synthetic resin head.

The instant invention will be described in conjunction with mandibular dentition as shown in FIGURES 1 and 2 wherein it is desired to install a retaining splint to overlie lingual areas of the anterior teeth **20** as well as the first bicuspids **22**. It will be understood that this particular splint installation is selected for illustrative purposes only and that the instant invention may be applied to a wide variety of tooth combinations. As will be seen from said figures, the initial step for the preparation of the teeth **20** and **22** for the reception of a splint comprises the location and formation of facial-lingual apertures **24** in the coronal portions of the aforesaid teeth. By reason of the instant invention, the location of the aperture in each tooth is determined by anatomic considerations for that particular tooth and entirely independently of the aperture location in any of the other involved teeth. Consequently, it is possible to locate the aperture in adequately spaced relation to the pulp of the tooth and its incisal edges for maximum and efficient support and retention. Having selected the appropriate

desired location for the aperture in each of the involved teeth, the apertures are formed by a suitable drill **26** provided with a countersink shank **28** as indicated in FIGURE 1. The lines **30** through the anterior teeth **20** and bicuspids **22** indicate the direction of the aperture axis in each of the aforesaid teeth. It will be noted that in involving the bicuspids **22**, the axis of the apertures may be formed in convergent relation. This condition would make it impossible to insert a horizontal pin splint of the prior art from the lingual side.

Having formed the apertures **24** as indicated in FIGURES 1 and 2 including countersink portions, locating pins **32** are inserted through the apertures as shown in FIGURE 3 and extend beyond the facial and lingual surfaces of each of the teeth. With the locating pins **32** in position an impression is then taken of the involved area as shown in FIGURE 4 using a rubber-type impression material **34** and an apertured tray not shown. Upon withdrawal of the locating pins **32** the impression **34** may be removed from the involved area and the locating pins may then be restored to their proper position in the rubber impression **34**.

The next step in the procedure is illustrated in FIGURE 5. As shown in said figure, a cast model **36** is formed from the impression utilizing an investment casting material capable of withstanding the temperatures involved in the lost wax process. Upon hardening of the investment cast model, the locating pins **32** may be removed and the resultant cast model **36** removed. An enlarged fragment of the cast model **36** is illustrated in FIGURE 6 showing that said model is an accurate reproduction of the involved area and includes the apertures or holes **24***a* formed in the cast teeth **40** precisely duplicating their location and orientation as initially formed in the natural teeth.

The next step in the procedure involves the formation of a wax-up corresponding to the configuration of the desired splint overlying the lingual areas of the involved teeth. As shown in FIGURE 7, a threaded pin **38** is inserted through each of the apertures **24***a* and a nut **42** of the configuration shown in FIGURE 14 is drawn up thereon. Since the nut **42** will form a part of the ultimate metal splint to be installed in the mouth, it is formed of a suitable dental metal such as a gold alloy or the like. It will further be noted that the nut **42** in addition to being internally threaded as shown at **44** is provided with end surfaces **46** disposed at a diagonal angle with respect to the axis of the nut. In view of the disposition of the end surfaces **46** of the nut **42** in a diagonal or oblique plane with respect to the axis of the nut it is possible to draw the nut into position as shown in FIGURE 7 so that a maximum area of the end surface of the nut is in contact with the confronting lingual surface of the tooth model and ultimately with the natural tooth. When the nut has been drawn up against the lingual surface of the model tooth and rotated so as to provide maximum surface contact between the end surface of the nut and the lingual surface of the tooth the nut is fixed in position by means of the application of a glob of sticky wax **48** or the like so as to fix the nut in position on the cast model of the tooth. When this has been accomplished, for all the involved teeth, the wax-up **50** of the splint body may be accomplished as shown in FIGURE 8 by coating the lingual surfaces of the model casting with a suitable investment wax. Having formed the wax-up of the entire splint as indicated in FIGURE 8, the next step in the procedure is to form a metal casting of the splint by the conventional lost wax process used in dentistry. This is accomplished by investing the cast model and its wax-up in a suitable investment casting material and casting out the waxed-up portion as shown in FIGURES 10 and 11 in a suitable dental metal. As will be seen from said FIGURES 10 and 11, which illustrate a form of metal cast splint **52**, said casting has incorporated therein the nuts **42** which are now precisely oriented in alignment with the natural tooth apertures. The splint **52** may now be installed in the mouth utilizing the screws **54** shown in FIGURE 15.

As may be seen from FIGURE 12, this installation is accomplished by locating the splint **52** against the lingual surfaces of the involved teeth **56** and inserting a screw **54** into each of the apertures in the tooth and threadedly engaging said screw with an associated nut **42** imbedded within the body of the splint in precise registration therewith. The screw is inserted until the screw head **58** is disposed within countersunk portion **60** of the tooth aperture as shown in FIGURE 13 and any excess metal of the screw head may be ground off as desired. It is preferred to form the depth of the countersink portion of the aperture so as to exceed the depth of the screw head **58** so that when completely seated within the countersink a space is available which may be filled with a material matching the tooth color if desired. It is also possible to form the screw with a head of a material matching the tooth color so that when in position it will match the tooth coloring and its location will not be discernible. A screw **62** of this type is shown in FIGURE 16 and may be formed by providing a threaded metal rod or pin **64** with a head **66** formed of a plastic material such as an epoxy or acrylic resin. The head **66** may be made large enough so as to permit being manually grasped and turned and is preferably stepped as shown at **63** to form a portion capable of entering the countersink. The distribution of pressure against the tooth surface by the enlarged area of the screw head prevents splitting of the tooth as the screw is drawn up and tightened. The screw head may then be cut and the portion remaining in the tooth countersink blends more easily with the tooth and improves adhesion of any covering material which may be employed. A minimum of metal, if any, is exposed along the facial surface of the tooth. Any excess of the screw stem extending beyond the lingual surface of the splint may be cut and ground off so as to provide a smooth continuum along the lingual surface of the splint. FIGURE 13 shows in cross-section the disposition of the splint in mounted relation to the tooth.

It will be noted from the foregoing that since the screws are inserted from the facial side of the teeth the requirement for parallelism in the tooth apertures is completely eliminated, and a simple procedure is provided for forming complimentary threaded portions in the splint in perfect alignment with the tooth apertures so as to permit the utilization of screw-threaded elements inserted from the facial side of the teeth. It will be further noted that in view of the non-critical character of the aperture locations in the teeth with respect to each other it is possible to select the most convenient and anatomically desirable location for the aperture in each screw and permits the formation of apertures in teeth where heretofore it has been impossible or impractical to do so. It will also be noted that the insertion of the screws from the facial side permits the overlapping of the splint to bicuspid teeth thus providing highly improved retention characteristics.

The instant method also permits for the production of splints which may be utilized for the support of artificial teeth used to replace missing teeth in the particular dental area involved. The method for the formation of a splint of this character is illustrated in FIGURE 9A, 9B and a resultant splint is illustrated in FIGURE 10A. Assuming a condition such as is illustrated in FIGURE 9B wherein one of the incisors **70** is missing as shown at **70***a*, the cast model **72** is waxed-up as illustrated at **76** in FIGURE 9A incorporating a waxed area **74** which will form a support for the missing tooth **70***a*. When a waxed-up model of the character shown in FIGURE 9A is cast out, a resultant splint **78** illustrated in FIGURE 10A may then be installed in the mouth after proper processing to incorporate the missing tooth. The splint thus provides an efficient and effective support **80** for an artificial tooth. Replacement of any of the natural teeth along the splinted

area may be made at a later date by anchoring a plastic tooth using one of the threaded pins for a support.

While I have illustrated and described the presently preferred embodiment of my invention, it will be understood that various changes and modifications may be made therein, without however departing from the inventive concept thereof as set forth in the appended claims.

I claim:

1. The method of retaining a plurality of teeth by means of a dental retaining splint which comprises locating and forming facial-lingual apertures in the coronal portions of the teeth to be retained and forming an impression of the involved dental area, including the orientation of axes of said apertures, forming a cast model including said apertures from said impression in an investment material, inserting a threaded pin through said apertures in said cast model, disposing a threaded nut on said threaded pin against the lingual surface of the cast of each of the involved teeth, said nut being disposed in axial alignment with its associated aperture, forming a wax-up of the desired splint along the lingual surfaces of the cast of the involved teeth and casting out a metal splint body by the lost wax process, whereby said nuts are encased in said metal splint body, disposing said splint body against the facial surfaces of the involved teeth and securing said splint body in place by means of screw-threaded members inserted from the facial side of the apertures in said teeth.

2. The method according to claim 1, wherein said wax-up includes the formation of a web spanning the area of a missing natural tooth, whereby the cast splint body will include a support for the replacement of a missing natural tooth.

3. The method of forming a dental retaining splint adaptable to be mounted in a mouth having teeth, each of said teeth having a facial surface and a lingual surface, said method comprising forming facial-lingual apertures in a plurality of said teeth which are to be retained, forming a wax-up of a splint having a surface configuration which corresponds to a plurality of said lingual surfaces and having a plurality of internally threaded recesses formed in the surface thereof each located in a position with respect to the other which corresponds to the position in which the facial-lingual apertures are each located with respect to the other, and casting out a splint body from the wax-up.

4. The method according to claim 3, including the step of inserting a pin through each of the facial-lingual apertures after forming said apertures to locate the splint position for each of the internally threaded recesses.

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ROBERT E. MORGAN, *Examiner.*