This invention relates to the manufacture of dental plates, and more particularly to what is known as an adjustable intra-oral tracer, the purpose of which is to assist the dentist and laboratory technician in shaping and forming the plates to insure proper vertical spacing between the jaws and thus not only secure correct bite but also preserve or produce the most desirable contour of the lips, cheeks and other soft tissues.

One object of the invention is to provide an improved tracer of simple form, capable of repeated use, and adapted for adjustment while the plate models are within the oral cavity.

Another object is to provide a tracer of the character described which is very compact, which may be molded in situ as a part of a bite plate, and which therefore is adjustable while in place in the oral cavity.

Still another object is to provide a tracer including a stem vertically adjustable to determine proper plate spacing, together with simple and effective mechanism including a member extending outwardly through the mouth opening for adjusting said stem.

Finally, another object is to provide an improved tracer of such form as to simplify and improve the present technique in the construction of dental plates, as will more fully appear hereinafter.

Further objects of the invention in part are obvious and in part will appear more in detail hereinafter.

In the drawings,

Fig. 1 represents a side elevation of a portion of the face, with the jaws closed, and showing the protruding operating shaft of our improved tracer;

Fig. 2 is a similar view, but with some of the soft tissues in section to expose the bite plates;

Fig. 3 is a front elevation of a pair of bite plates formed and equipped according to our invention;

Fig. 4 is a sectional elevation on the line 4—4,

Fig. 3, but showing the tracer in elevation;

Fig. 5 is a bottom plan view looking upwardly along the line 5—5, Fig. 3, and illustrating the operating shaft in operating position;

Fig. 6 is a plan view, looking downwardly along the same line, Fig. 3; and

Fig. 7 is an enlarged sectional view through the tracer along the line 7—7, Fig. 5.

The tracer forming the subject matter of the present invention can best be explained by a description of the technique of which it forms a part. It may be assumed, as an example, that a dental technician, in his laboratory, possibly remote from the office of the dentist, is assisting in the preparation or fabrication of dental plates in accordance with measurements and other instructions obtained and supplied to him by the dentist as the result of his examination of the patient's mouth. The cooperative procedure of the dentist and his technician is as follows:

First the dentist prepares a pair of upper and lower jaw impressions in any suitable plaster or other material, by standard procedure, requiring neither illustration nor detailed description.

Next, he prepares the usual wax mush bite form (not shown), to simulate the true bite relation of the two jaws, and also establish an arbitrary vertical spacing relation between them, as a basis from which, to work later on, as will appear.

The two impressions and the mush bite form are sent to the technician, who proceeds as follows:

First, he fabricates two models (not shown) from the two impressions, one for each jaw. The models are complementary to the upper and lower jaw impressions furnished by the dentist and simulate the upper jaw and palate and the lower jaw respectively of the patient. These models are mounted on the hinged arms of the usual articulator (not shown) by means of which they may be relatively moved to simulate ordinary bite action. Base plate members are then made conforming to the models. The upper plate comprises an impression 10 similar to the impression made by the dentist and includes an integral central portion 10a across the palate. The lower plate comprises an impression 11 adapted to fit the lower jaw of the patient. The plate members 10, 11, are temporary and may be made of any suitable material for the purpose, such as a hardening plaster or a plastic material. Each is a thin walled concavo-convex member accurately conforming to fit the corresponding jaw model member on its concave face and curved smoothly on its convex face.

Assuming the two models attached to the articulator, the technician adjusts the articulator arms to close the base members together upon the mush bite form, thus bringing them into exactly the same bite relation existing when the mush bite form was produced. The closing stop on the articulator is set to establish this relation, which of course includes the arbitrary vertical jaw spacing before referred to.

Next, the technician applies wax to the base
plates 10, 11 as at 12, 12a, and builds them up to convert them into bite plates. The built up wax supplies to the base plate material to temporarily take the place of the teeth to be applied later, and to support the soft tissues around the mouth and lips, and to limit approach of the two jaws, in the model, to a position just a little short of that where the teeth will be in bite engagement. The height or depth of wax thus applied or built up is a matter of experience and judgment and of knowledge of the teeth to be used. It is best to be familiar with these details in this art.

At the same time the technician imbeds in or secures to the upper plate member 10, with its central axis vertical and at the center of the jaw, a tracer made according to our invention and marked generally as 14 and later described more in detail. This he accomplishes by imbedding the Shank or head 15 of the tracer in wax or plaster 10b applied to the inner or concave face of the upper plate member 10 as shown in Fig. 4. He also applies or attaches to the lower plate member 11, with wax or plaster, a thin flat metal plate 16, made for example of aluminum, and the upper surface of which may be coated with colored paint or other material to show scratch traces upon it.

All parts so far prepared are now returned to the dentist for further adjustment in the mouth of the patient.

But, before explaining that procedure, it may be well to here describe the particular embodiment of our tracer shown in the drawings solely for purposes of illustration, it being understood that the invention is not limited to this form but only within the scope of the claims appended hereto.

The tracer 14 of course is quite small and compact, because it goes into the oral cavity and must not interfere with comfortable closing of the jaws. It comprises a body portion 14a of generally cylindrical form having a flat transverse face 17 at one end and a reduced shank 18 at the other end provided with a flanged head 15 by means of which it may be firmly and immovably imbedded in the securing wax or plaster.

The body is hollowed out to provide an inner cavity or chamber 19 within which is mounted the tracer member 20, the inner end of which protrudes through face 17 and is pointed, as at 21. The upper end of said tracer lies within a reduced extension 22 of the chamber 19.

Suitable operating means is provided for adjusting the tracer member 20 longitudinally or endwise in said chamber in such manner as to vary the position of its pointed end. This operating means may be of any form, so long as the adjustment may be made while the tracer is within the oral cavity and does not interfere with the form or position of the soft tissues, such as the lips. The tracer member moves in a straight line which is approximately normal to the occlusal plane which is roughly indicated by the line 5-5 of Fig. 3.

In the form shown the tracer member 20 is a threaded screw, longitudinally slotted along one side to receive the inner end of a headless set screw 23, which prevents rotation of the screw but permits its endwise adjustment. On the screw is mounted an internal threaded nut or actuating member in the form of a bevel gear 24, which meshes with a similar gear 25 on the inner end of a shaft 26 rotatably mounted on a horizontal axis in a plug 27 driven into an opening in the body wall. Shaft 26 has a noncircular, such as square, recess 28 in its outer exposed end to receive the inner end of a key shaft 29 by means of which the gearing may be turned in either direction. When the tracer is molded into its fixed position it, of course, is turned to such position that the recess 28 is presented outwardly toward the patient, preferably one of the ends or corners of the opening, and a hole or aperture 30 is cut out or dug through the wax opposite said recess.

The purpose of our tracer is to enable the dentist to relatively adjust the bite plates of a pair, while they are properly co-related in the oral cavity, in such manner as to secure or determine that particular vertical spacing between said plates which provides or produces the desired, or the most pleasing, appearance or external contour of the soft tissues, such as the lips. With age, the teeth wear down, so that later in life it may be desirable, in new plates, to appropriately increase the vertical spacing, while with the first set of plates it is equally desirable to limit the same to the present best relation. In either case the best results are secured only when the adjustment is made while the bite plates are in the oral cavity.

The plates and models, prepared by the technician, as described, are returned to the dentist. He inserts the bite plates in the mouth, as in Fig. 2, and pushes the square end of the key 29 between the lips and inserts it through opening 30 into the square driving recess 28, as in Fig. 1. Then he turns the key to adjust the tracer screw with its pointed end engaging the surface of the flat aluminum plate 16, as in Fig. 4. The adjustment is continued by movement of the tracer screw up or down to an optimum position, in which the lips, relaxed or in repose, present the most desirable external contour or appearance, or where the bite is comfortable to the patient, or by the criterion of the individual dentist.

The patient is then requested to move his jaws as though to grind his teeth, the effect being to cause the tracer point to slide upon plate 16, the axis of which is the at the central vertical axis of the jaws. This axis is usually marked perma-

ently with a small hole 31, Fig. 6, into which the tracer screw will extend. After hole 31 is drilled the plates are removed, and checked in the patient's mouth with point 21 in hole 31, and readjusted, if necessary.

The operating shaft is withdrawn and the bite plates are temporarily secured together, or in fixed relation by means of wax or plaster of Paris, and with them so secured, the two plates, as a unit, are removed from the mouth and returned to the technician in that condition.

He secures the bite plate to the articulator arms as before. This is accomplished by first mounting one bite plate, say the lower, upon its base or body member, and then closing the other arm of the articulator, with the other body member, down upon the first, to bite engagement. The articulator closing stop is then adjusted to this new relation.

Now, the wax or composition fastening the two plates together may be removed, to free them, and the tracer, aluminum plate and the securing wax therefor may be also removed. The relative, the bite plate models mounted on the articulator arms in true bite relation, but with the vertical spacing determined by the dentist from the patient's mouth, and enables the technician to proceed with other usual steps of manufacture of finished plates with the assurance that when
they are conformed to and fitted upon the patient's jaws the desired external facial contour will be produced.

The key 29 may be made a permanent part of the tracer, such as by making it a fixed part of gear 25 and its shaft 26, in which case it is molded into the wax and usually turned slightly as the wax hardens, to free it for later operation.

What we claim is:

1. An intra-oral tracer of the character described, comprising a body member externally of such shape as to enable it by molding to be attached in fixed position to a dental bite plate, a tracer member mounted in said body member for straight line movement approximately normal to the acclusal plane, and an operator for said tracer member in rod form and of small diameter adapted to extend outwardsly through the mouth opening for actuation of the tracer member while it is in place in the oral cavity.

2. A tracer of the character described in claim 1, in which said body member is provided with an inner chamber, into which the tracer member extends, and including operating connections between said operator and tracer member enclosed within said chamber.

3. A tracer of the character described in claim 1, in which said body member is provided with an inner chamber, into which the tracer member extends, and including operating connections between operator and tracer member enclosed within said chamber, said operator being detachably connected to said operating connections.

4. A tracer of the character described in claim 1 wherein means is provided for causing said straight line movement of said tracer member including a pair of coacting bevelled members one of which is mounted on said tracer member and the other of which has a detachable connection with said operator.

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