A Method for Determining the Maxillary Incisor Inclination

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For many years researchers and clinicians have given a considerable amount of attention to placing the maxillary central incisors in their most esthetic position.

To have a pleasing result it is important for this tooth to have a good axial inclination. The axial inclination has been determined by drawing a line through the long axis of the tooth. In other studies this line has then been related to SN, the Frankfort horizontal plane, NA and to the line through the long axis of the mandibular incisor.

After viewing approximately 100 tracings of central incisors, it became obvious to the author that there was a significant difference in the lateral view of the facial contour, defined by an approximation to the tangent of the labial surface, compared with the long axis of the tooth. After recognizing this difference, it became important to the author to find a method of measuring the extent of the difference, and then determining by intuitive observation whether it should be considered during treatment planning and bracket selection.

OBJECTIVE

The object of this investigation is to see how a tangent-like line which will be called the maxillary incisor facial line, drawn parallel to the labial surface of the central incisor, varies with a line drawn through the long axis of that tooth and how this information may be utilized to assist us in positioning this tooth for the optimum in esthetics.

Read at the January, 1973 meeting of the Midwestern Component of the Angle Society.

METHODS

Sample Size

Thirty extracted maxillary central incisors were used, each of which were placed on and to be viewed laterally on an ultraspeed, double emulsion film. The distal surface of the incisor was adjacent to the film and the incisal edge was kept at right angles to it. A long cone of 16 inches focal film distance was used; the x-ray tube was kept at 90° to, and in contact with, the film while an exposure was made. An accurate tracing of the incisor was made and the long axis of the tooth determined by drawing a line from the apex of the crown to the junction of the labial and lingual enamel plates at the incisal edge.

Bracket Slot Placement

Since the labial surface of the maxillary central incisor has a varying amount of curvature incisal-gingivally, it was important to determine at what point on the incisal surface the maxillary incisor facial line should be drawn. To be able to apply some results from this investigation for clinical benefit, this point needed to be at the position where the slot of the bracket would be located. To determine this point thirty patients were selected at random and the distance from the incisal edge of the tooth to the middle of the slot in the bracket was measured. This distance varied from 3.8 mm to 4.4 mm with an average of 4.2 mm. Consequently, a point 4.2 mm gingivally from the incisal edge on the labial surface was marked and a horizontal line was drawn to form a right angle to the labial surface at that point. Then a perpendicular line was drawn to in-

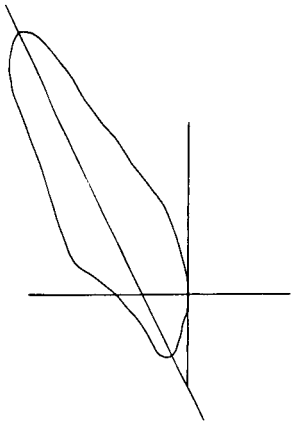

Fig. 1

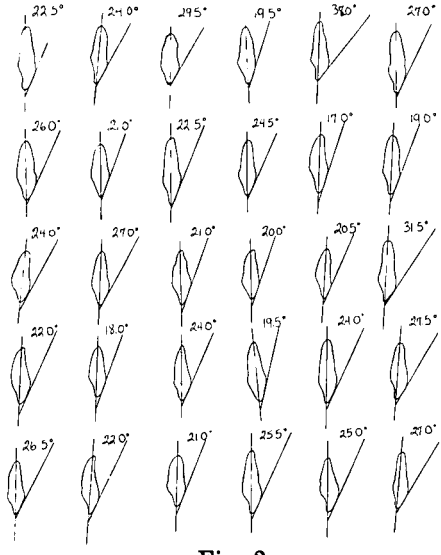

Fig. 2

tersect the horizontal line at the bracket point previously mentioned (Fig. 1). This perpendicular line gives a fairly good indication of the inclination of the labial surface compared with the line drawn through the long axis of the tooth.

Findings

Figure 2 shows each of the thirty angles measured in this study. They ranged from 17 to 38 degrees. This angular difference of 21° reflects a considerable difference in the shape or curvature of the labial crown surface compared with the long axis of the tooth. Since the appearance of the incisors (after debanding and especially after the postretention years) is dependent upon that part of the tooth that one can actually see, which is the clinical crown, then the tooth with the 38° angle certainly should have more lingual root torque than the one with a 17° angle.

Figure 3 shows a tracing of these two extreme cases showing the root and the crown with the long axis of both teeth at an angle of 103° to SN. After looking at literally hundreds of x-rays, the author and the clinicians in the office became so used to looking at the line drawn through the long axis

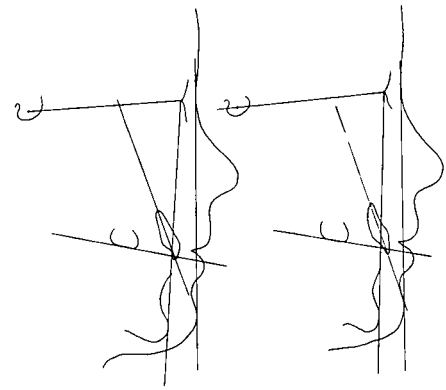

Fig. 3

of the tooth that we paid very little or no attention to the appearance of the clinical crown.

Figure 4 shows the same two teeth in the same skeletal pattern, but the drawing shows only the outline of the clinical crown and the maxillary incisor facial line. This gives an entirely different appearance to these teeth regarding their most esthetic axial inclination, and it allows the clinician to become much more aware of the contour of the labial surface and total dental-facial esthetics.

There are many clinicians who do

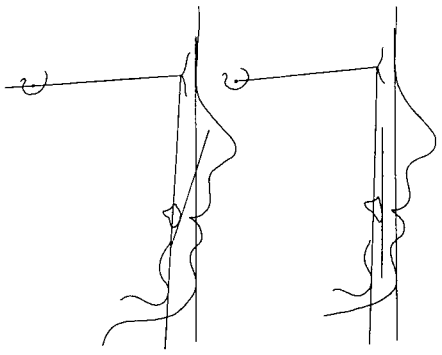

Fig. 4

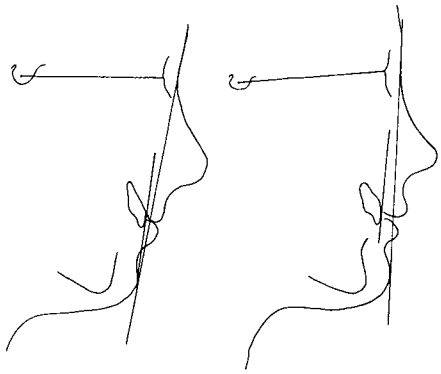

Fig. 5

not routinely take lateral head x-rays during the last phase of treatment to determine if they are satisfied with the inclination of the maxillary incisors; the majority use clinical judgment to determine their satisfaction. Obviously, if one is "eyeballing" this tooth for acceptance esthetically, we must be relating it to some landmarks. After asking a number of patients to stand and smile broadly, the author soon realized he was relating the labial crown surface contour to the soft tissue facial line, i.e., a line drawn from soft tissue nasion to soft tissue pogonion.

The next procedure was to take photographs and lateral head x-rays of twenty-five patients who had quite attractive smiles, which reflected a favorable position of the labial surface from the author's point of reference. Naturally, some of these were more attractive than others which is the case in any office. Each lateral x-ray was traced as in Figure 8 and the angle formed by the maxillary incisor facial line to the soft tissue facial line was measured. The labial crown surfaces that showed a lingual inclination were recorded as a negative angle and those with labial inclination were recorded as a positive. These angles ranged from a minus 8.5 degree to a plus 6.0 degree.

Obviously, some place in between these two extremes the practitioner should find a small range of angles that is most ideal in his mind. This is where the requirements of the individual clinicians will be expressed. After scrutinizing the photographs and the x-ray tracings of these twenty-five patients, the author was pleased with those cases that fell between a positive 3 degree and a negative 3 degree range (Fig. 5). This happened to include fourteen of the twenty-five patients. It should be pointed out here that this range possibly may not meet with your approval.

Most of you have looked at many template tracings of the maxillary central incisor. The template may or may not have the same labial crown contour as the actual tooth being traced. The maxillary incisor facial line to the long axis angle of the template commonly used is 19°. This compares quite favorably to the average angle of this sample which was 24°. However, the range of this angle is so large that it makes it impossible to give individualized treatment to the patient with unusual labial crown contour whose angle falls at the periphery of the range. A vivid example of this are the two tracings in Figure 6. The tracing on the right uses the template and the tracing on the left is the actual tracing of the tooth. The

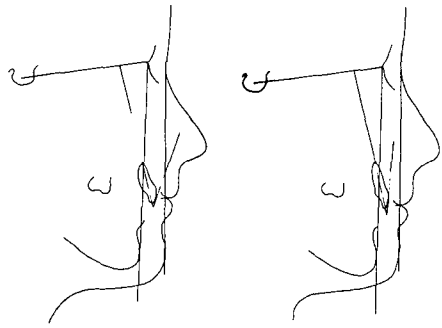

Fig. 6

angle formed by the maxillary incisor facial line with the soft tissue facial line is -2.5° on the template tooth while it actually is -17.5°. This represents too much of an angular discrepancy to not be considered in a treatment plan. A 10° to 12° lingual root movement would enhance the esthetic appearance of this tooth considerably. When tracing head x-rays, it is obvious to most of us that some personal judgment must be used. For instance, drawing a line through the long axis of a tooth, locating Point A, determining the Frankfort plane, and drawing the mandibular plane will vary slightly between individuals. Such is the case in drawing the maxillary incisor facial line to the labial surface. It was rather reassuring to discover that the average angle of the maxillary incisor facial line to the long axis was 23.88° in the study of the thirty extracted incisors and was 24.14° in the study of the twenty-five head x-ray tracings. This shows an average difference of only 0.26° in this angle in two different independent surveys. At any rate, the minuteness of this difference gives confidence to proceed to use this angle for clinical consideration during a treatment plan.

Applied Clinical Use

To be able to utilize this information clinically requires the clinician to know the maxillary incisor facial line to the soft tissue facial line angle and

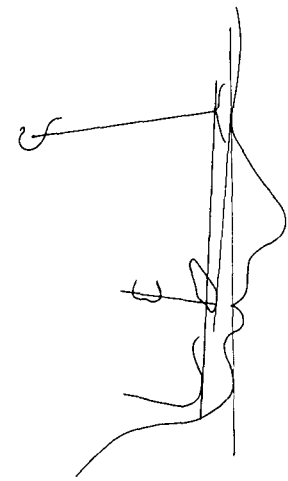

Fig. 7

the maxillary incisor facial line to labial arch line angle. To be able to draw the labial arch line one needs to know the normal position of the buccal tube occlusal-gingivally the same way the bracket slot is located on an incisor. With some simple addition and subtraction one should be able to determine the amount of torque needed in a rectangular archwire or the degree of the opening in the slotted brackets.

In Figure 7 the maxillary incisor facial line to the soft tissue line angle is -4° which is acceptable. Obviously, this means that any movement of this tooth labially or lingually should be a bodily movement. The other angle to consider is the labial arch line-maxillary incisor facial line angle. In this case it is 86°. Since this is four degrees less than a right angle, it indicates a four degree slotted bracket, or four degrees of lingual root torque in the archwire should allow a .022 rectangular wire to fit passively in a .022 bracket opening.

Figure 8 shows the maxillary incisor facial line-soft tissue facial line angle to be -33°. The maxillary incisor facial line-labial arch line angle is 110°. If a 0° slotted bracket and a high tolerance

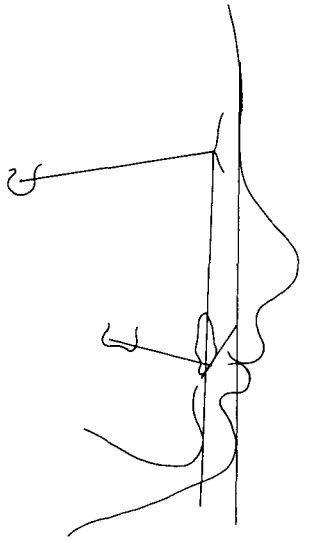

Fig. 8

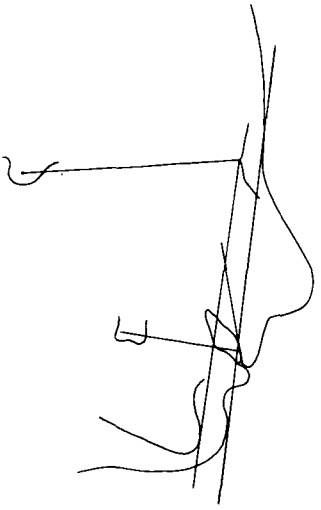

Fig. 9

edgewise archwire is placed, this tooth should have 20° of lingual root torque, i.e., 110 minus 90 is 20. To get the maxillary incisor facial line parallel to the soft tissue facial line would require an additional 13 degrees of torque either in the archwire or by using a 13° slotted bracket. Thus 33 degrees of lingual root torque should place the labial surface in a desirable location.

Figure 9 illustrates a case of the opposite extreme. It has a maxillary incisor facial line-soft tissue facial line angle of plus 17 degrees. The incisor facial line-labial arch line angle is 70 degrees. If a 0° slotted bracket is used and a high tolerance edgewise wire is placed, this tooth would theoretically have 20 degrees of lingual crown torque or labial root torque and would have a maxillary incisor facial line-soft tissue facial line angle of —3 degrees. If a plus two degree angle were desired, a 5 degree slotted bracket or 5 degree torque in the archwire should theoretically give that end result.

However, clinical practice has shown that, if the incisors need to be moved lingually, additional lingual crown torque is necessary to get bodily movement or if the root is going to be moved lingually at all, additional torque is necessary. The amount of additional torque needed depends mainly on four factors: the distance the incisors are to be moved lingually, the period of time the archwire is in place, the patient's tissue response to pressure, and the tolerance of the rectangular wire to the bracket opening.

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