# The Tweed Formula, Anchorage Preparation And Facial Esthetics*

B. L. Herzberg, D.D.S., M.D.S.
*Chicago, Illinois*

Tweed, rather early in his orthodontic experiences, found that a large proportion of his finished cases became failures because either the patients had poorer facial esthetics when completed or because of the relapse by way of tooth alignment. It both instances, the failures were due to expansion of the tooth arches in the labial or buccal segments, or both, and frequently led to recession of the gingival tissues. To combat these failures at first, Tweed began to upright mandibular incisors over mandibular base at the expense of excessive expansion in the buccal segments and in the cuspid areas. Quite rapidly, he found that he could not maintain buccal expansion to any appreciable degree and it became necessary to remove tooth units to upright lower incisor teeth without much expansion.

At this stage of his orthodontic development Tweed stressed the importance of the incisor-mandibular plane angle, holding that the normal range of variability was ten degrees, from eighty-five degrees to ninety-five degrees, which he originally called minus five, zero and plus five. Subsequent work on this angle by the research workers tended to prove Tweed's theory. The notable work on the incisor-mandibular angle was done by Margolis[2], working with oriented cephalometric X-rays. Tweed, to position the lower incisors relatively upright on basal bone and yet not to expand either in a lateral or labial direction, developed the appliance adjustment that he called toe hold or mandibular anchorage and this became a most important factor in his therapeutic efforts.

Tweed's[3] next contribution had to do with the Frankfort-mandibular plane angle and its use in diagnosis and prognosis. With reference to this angle, Tweed held that where the size of the angle was from twenty to thirty degrees, from excellent to good results could be obtained in facial esthetics and that "excellent" changed to "good" as the larger angle was approached. When, however, the angle reached thirty-five degrees, only fair facial esthetics could be obtained through orthodontic treatment and above thirty-five degrees, the result, in facial esthetics, would be poor. It was at this stage that I pointed out that the farther lingually the lower incisors were uprighted in orthodontic treatment in the presence of large Frankfort-mandibular angles, the better would be facial esthetics; but I hastened to add that greater orthodontic skills were acquired to so upright incisor teeth in such cases and, too, there definitely were limitations to orthodontic treatment.[4] Now, with greater efforts being expended to upright lower incisor teeth, mandibular anchorage became of greater importance.

The latest contribution of Tweed[5] has to do with the mandibular incisor-Frankfort plane angle and is defined as the angle formed by a line drawn

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through the long axis of the lower central incisor and the Frankfort horizontal. Now Tweed had three angles and three planes forming a triangle. The sum of all angles of any triangle being one hundred and eighty degrees, with a mean of ninety degrees as the incisor-mandibular angle and twenty-five degrees as the mean for the Frankfort-mandibular angle, the mandibular incisor-Frankfort angle had to be sixty-five degrees. This sixty-five degrees Tweed designated as the minimal requirement for facial esthetics where orthodontic treatment was instituted.

For all practical purposes, the Frankfort-mandibular angle is not changed by orthodontic therapy but lower incisors may be uprighted as much as twenty-five degrees, which in turn is reflected to the mandibular incisor-Frankfort angle. In drawing attention to the mandibular incisor-Frankfort angle, Tweed used the oriented cepahlometric X-ray. He drew his triangle directly on the head plate. The X-ray plate thus used became a very important adjunct in diagnosis, focusing attention upon the degree of labial procumbency of the lower incisors and the correction needed to bring the mandibular incisor-Frankfort angle to the minimal requirement of sixty-five degrees. If the required movement was beyond the possibilities of experience, it immediately became apparent that prognosis was poor. On the contrary, if ample space existed into which to upright lower incisors, whether in extraction or non-extraction cases, the prognosis became excellent. It became possible now to follow the progress of treatment with oriented lateral head plates and thus to determine the advisability of carrying treatment further to attain the sixty-five degree mandibular incisor-Frankfort angle minimal requirement. It becomes necessary with this newer knowledge to, at times, increase the toe hold or mandibular anchorage to continue on to treatment goals. When the problems of greater tooth movement or smaller available space into which to move teeth, or severe combinations of both, occur, then we know that the maximum amount of mandibular anchorage must be established. The anchorage must be developed by closure of mandibular spacings and by uprighting and tipping back of buccal and incisor teeth, using sharp tip backs in the lower archwire, Class III elastics from the maxillary arch, which also has tip backs of a milder degree and is tied back as a unit of anchorage, the whole being reinforced or augmented by cervical or other extra-oral force.

Tweed, with this new method of diagnosis, was able to use the yardstick of the mandibular incisor-Frankfort angle in conjunction with intra-oral X-rays and good models to determine, in mixed dentition cases, the amount of available space and the quantity of needed space much in the manner suggested by Hayes Nance. Tweed supplemented this by the degree of labial inclination of the lower incisors and the amount of space required to upright these incisors to attain the minimal requirement of sixty-five degrees for the mandibular incisor-Frankfort angle.

The use of these angles as suggested by Tweed in diagnosis and prognosis gives the orthodontist diagnostic acumen that has hitherto been unknown. Couple with this the technique of developing mandibular anchorage, of space closure, of uprighting and rotation of individual teeth, of adjusting mesio-distal relationships and of artistic positioning of individual teeth, and we have at our command a diagnostic and therapeutic orthodontic procedure that augurs well for the service we may render our patients and for the justifiable pride that we may take

in our work and attainments.

To graphically illustrate the use of the mandibular incisor-Frankfort angle, one case will be reported showing an intermediate oriented lateral head X-ray to demonstrate the progress of treatment and the degree to which we are approaching our minimum goal of a sixty-five degree mandibular incisor-Frankfort angle (Figures 1, 2 and 3). A second case will be displayed where complete records are available so that we may ascertain the amount of change in the mandibular incisor-Frankfort angle (Figures 4 and 5). The second head plate will be corrected for the Frankfort horizontal by registering at the center of sella turcica and superimposing on the S-N plane. The effect of a bite plane will be shown by use of the mandibular incisor-Frankfort and the incisor-mandibular angles (Figure 6). It will be pointed out that some individuals with Frankfort-mandibular angles of twenty-five degrees or less may have smaller mandibular incisor-Frankfort angles than sixty-five degrees and still be very well balanced and acceptable esthetically (Figures 7, 8, 9 and 10). In such cases it may not be necessary to remove teeth in treatment.

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7200 *S. Exchange Avenue*

Fig. 1. Oriented photographs before (above) and after treatment (below) of a patient whose treatment required extraction of the four first bicuspids.

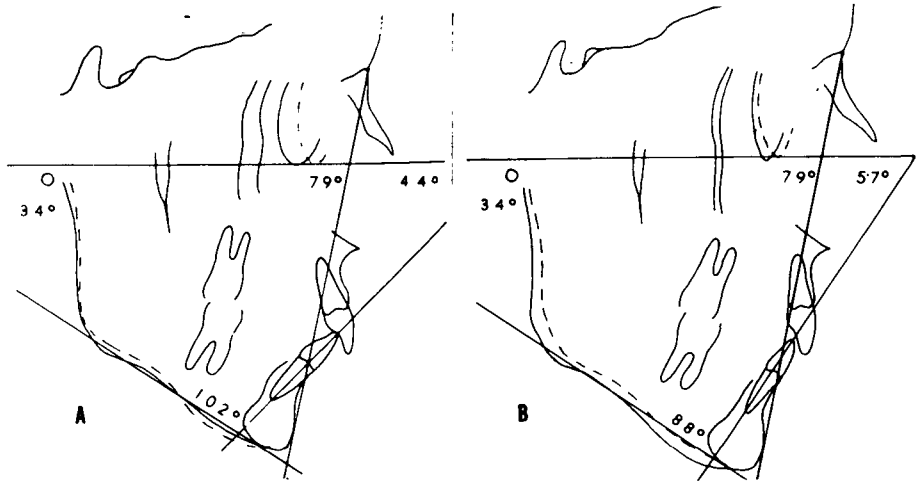


Fig. 2. Tracings before (A) and after treatment (B) of patient seen in Fig. 1.

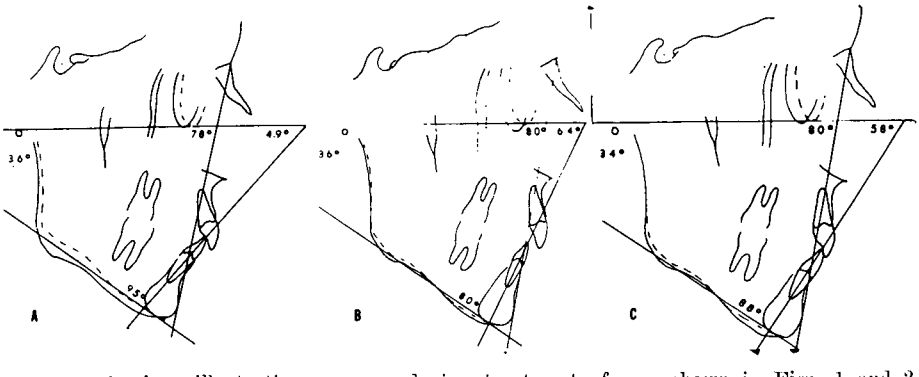


Fig. 3. Tracings illustrating progress during treatment of case shown in Figs. 1 and 2; A, cuspids retracted; B, end of Class III mechanics; C, end of Class II mechanics.

Fig. 4. Oriented photographs before (above) and after treatment (below).

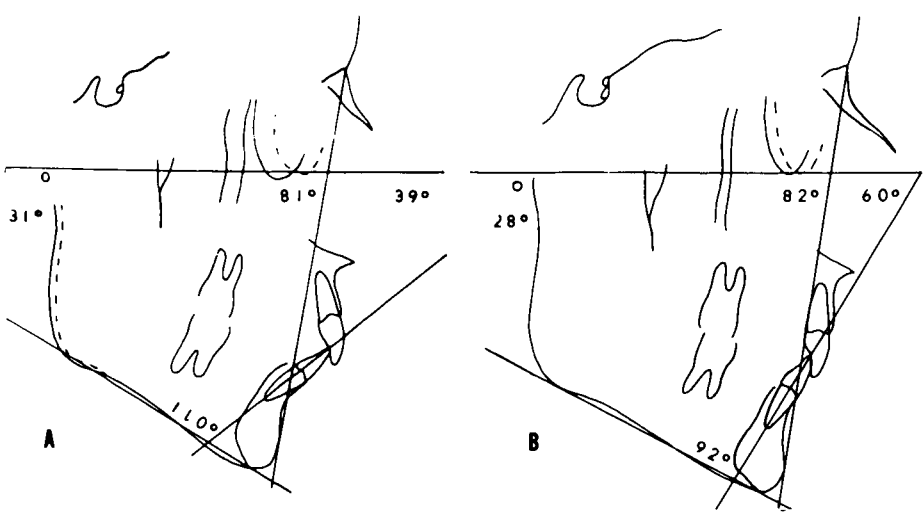


Fig. 5. Tracings before (A) and after treatment (B) of patient No. 1415, seen in Fig. 4. Note twenty-one degree change in mandibular incisor-Frankfort angle.

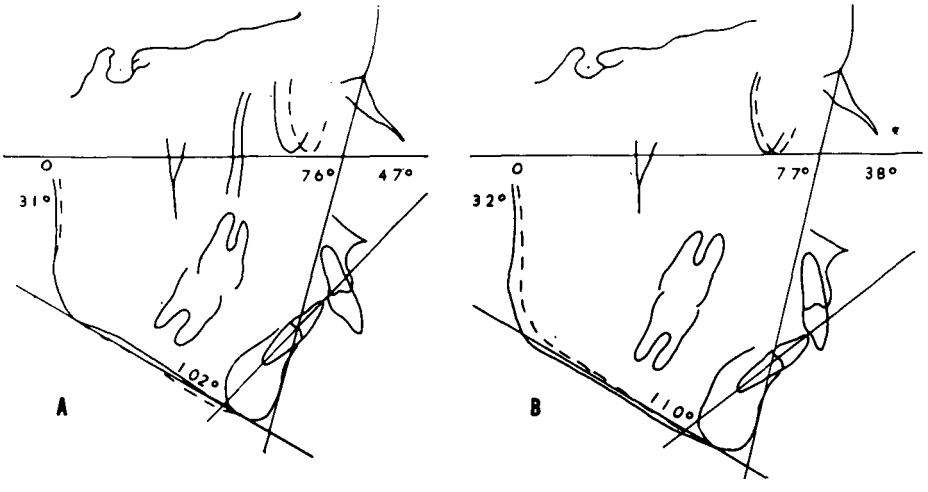


Fig. 6. Tracings before (A) and after treatment (B) of patient No. 1557 showing the effect of a biteplate on the mandibular incisor-Frankfort angle. The mandibular incisor procumbency has increased by nine degrees; biteplanes should be so designed and used as not to produce this undesirable action.

Fig. 7. Oriented photographs before (above) and after treatment (below) of patient whose treatment required extraction of the four first bicuspids.

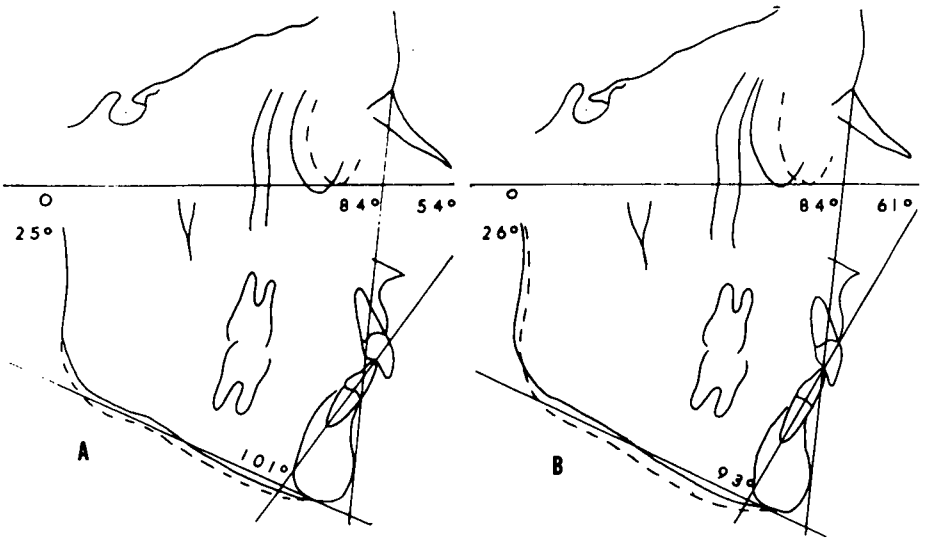


Fig. 8. Tracings before (A) and after treatment (B) of patient No. 1572 (see photographs in Fig. 7) showing uprighting of mandibular incisors of seven degrees, i.e., an increase of mandibular incisor-Frankfort angle from fifty-four degrees to sixty-one degrees. Facial esthetics are acceptable even though this is four degrees more procumbency than the formula of sixty-five degrees.

Fig. 9. Oriented photographs before (above) and after treatment (below) of non-extraction case.

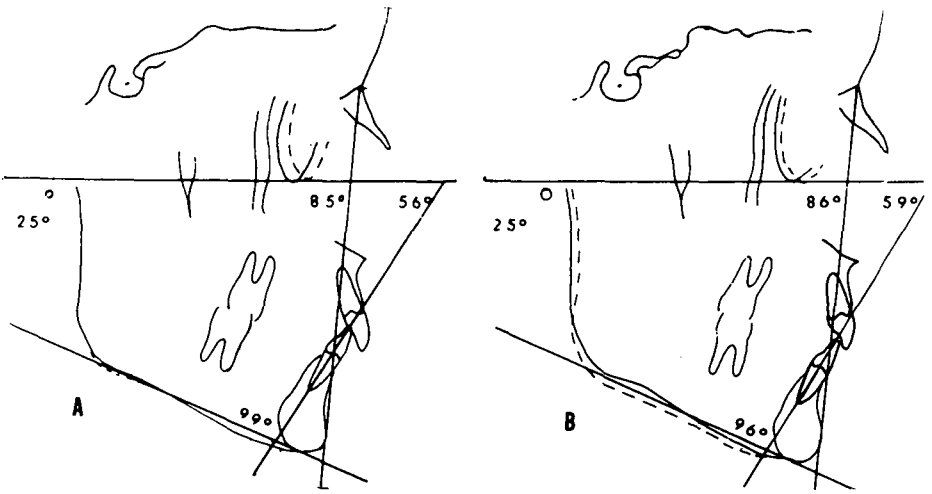


Fig. 10. Tracings before (A) and after treatment (B), of patient No. 1646 treated without extractions (see photographs Fig. 9), showing a mandibular incisor-Frankfort angle of fifty-nine degrees, an improvement of three degrees. Facial esthetics are acceptable provided case remains stable. In such favorable instances, extractions are not required and attainment of the sixty-five degree mandibular incisor-Frankfort minimum is not needed; the operator's appreciation of facial esthetics must modify the formula in selected cases.


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