



Readout

Herbert A. Klontz, D.D.S., M.S.

Many orderly and progressive changes have taken place at the two week Advanced Course in Edgewise Mechanics that is sponsored by the Charles H. Tweed International Foundation for Orthodontic Research. A philosophy is taught whereby the total orthodontic treatment regimen can immediately be put to use by the graduate. The course content includes complete orthodontic diagnosis, techniques of mechanics utilizing prepared typodonts, tooth movement monitored with each wire sequence, the concept of *Tweed occlusion* with subsequent recovery, and practice management controls. The mechano-therapy is the most important phase that includes detailing the force systems developed by Dr. L. Levern Merrifield.

Tweed Occlusion

Objectives of orthodontic treatment include a well-defined set of occlusal relationships called *Tweed occlusion* (Figure 1). It refers to overtreatment, and is a very definite part of the overall treatment. The teeth are positioned with the mandibular arch flat while the maxillary arch exhibits an accentuated curve of Spee. The maxillary posterior teeth are tipped distally so that the

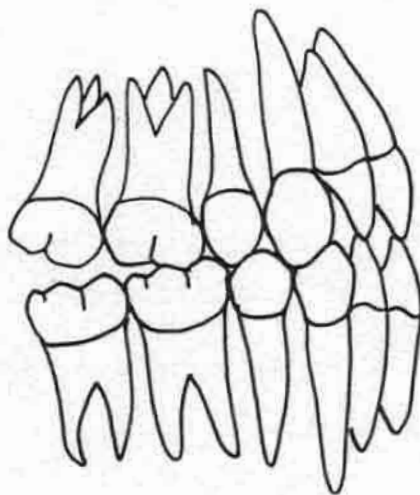


Figure 1. Tweed occlusion

mesial buccal cusp of the first molar is in contact with the buccal groove of the mandibular first molar. Both the maxillary and the mandibular second molars are distally tipped, completely out of any occlusion. The anterior teeth are placed close to an end-to-end position. Tweed occlusion is further characterized by a balanced skeleto-facial complex because the denture is positioned upright over basal bone for maximum stability and esthetics.

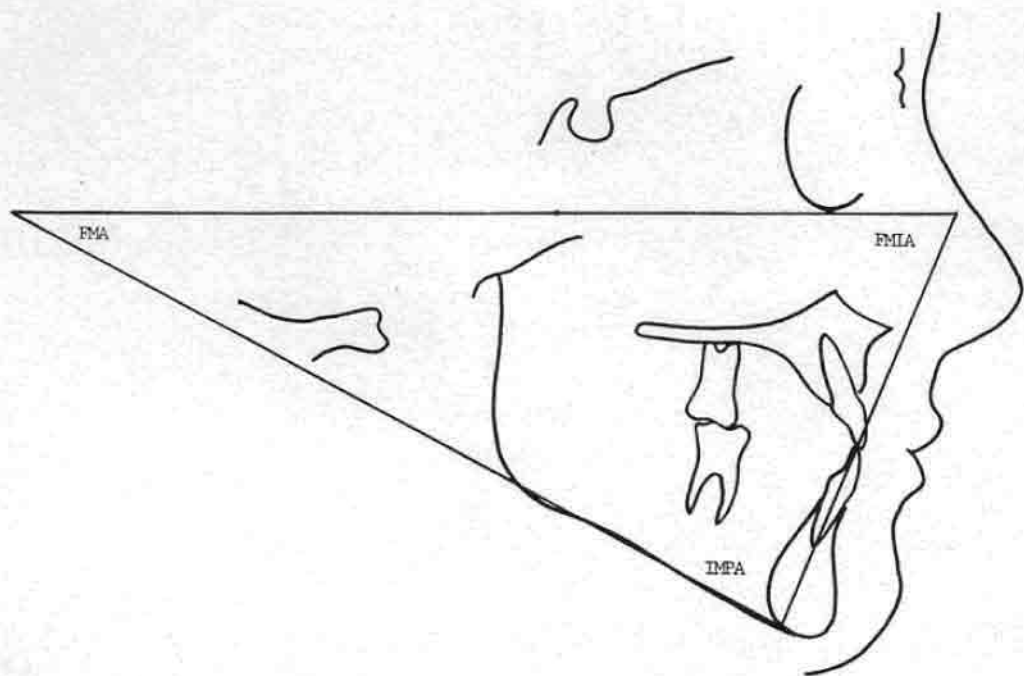


Figure 2. Tweed diagnostic facial triangle



Figure 3a. Appliances, right side

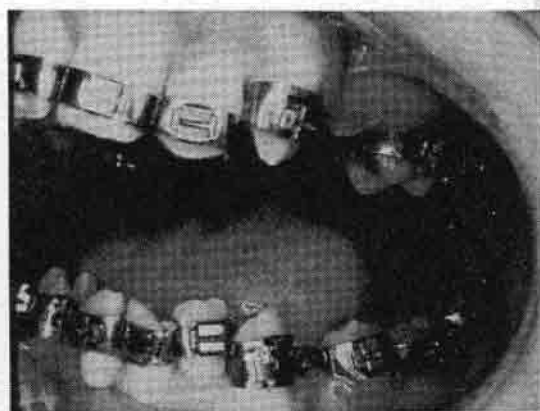


Figure 3c. Appliances, left side

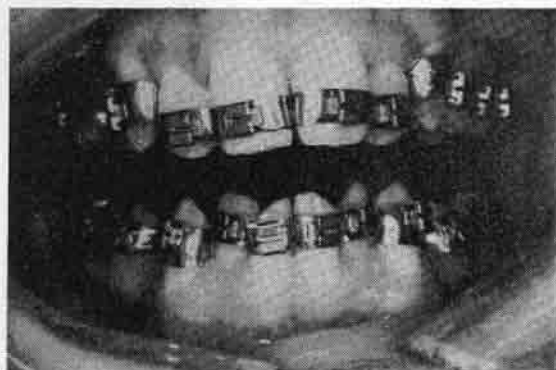


Figure 3b. Appliances, anteriors

The anterior part of the denture is guided by the Tweed triangle (Figure 2), while the necessary inclinations of the posterior teeth are monitored with readout.

Definition

One of the recent additions within the Advanced Course in Edgewise Mechanics has been *readout*. It is an orderly and efficient means of monitoring tooth movement to achieve the desired Tweed occlusion. Very few objectives are defined with accurate

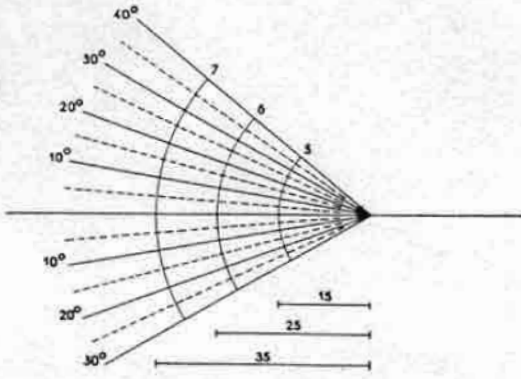


Figure 4. Formula card

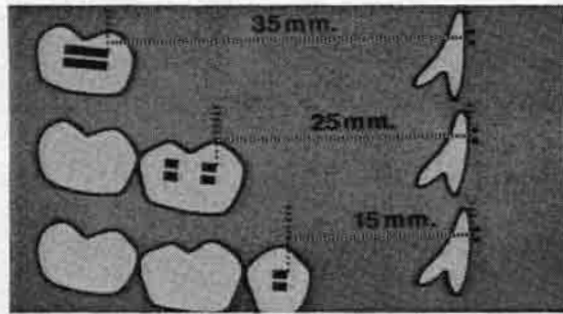


Figure 5. Average distances from the central incisors to the posterior teeth

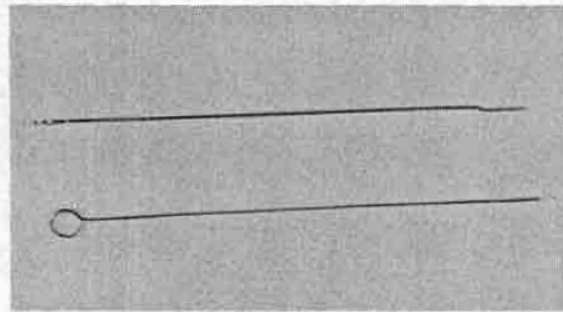


Figure 6. Readout wires

measurements in orthodontics; however by using readout, teeth can be placed in predetermined positions with great accuracy. It is a precise way to measure the inclinations of the posterior teeth at any stage of treatment. It is a means of consistently and accurately producing Tweed occlusion.

Procedure

A simple method for taking a readout is as follows: The malocclusion is banded

(Figure 3). Figure 4 illustrates a formula card used to calculate the amount a tooth is tipped. Figure 5 depicts the distance from the second bicuspid to the lower anterior bracket averages fifteen millimeters; the distance from the lower first molar bracket to the lower anterior bracket averages

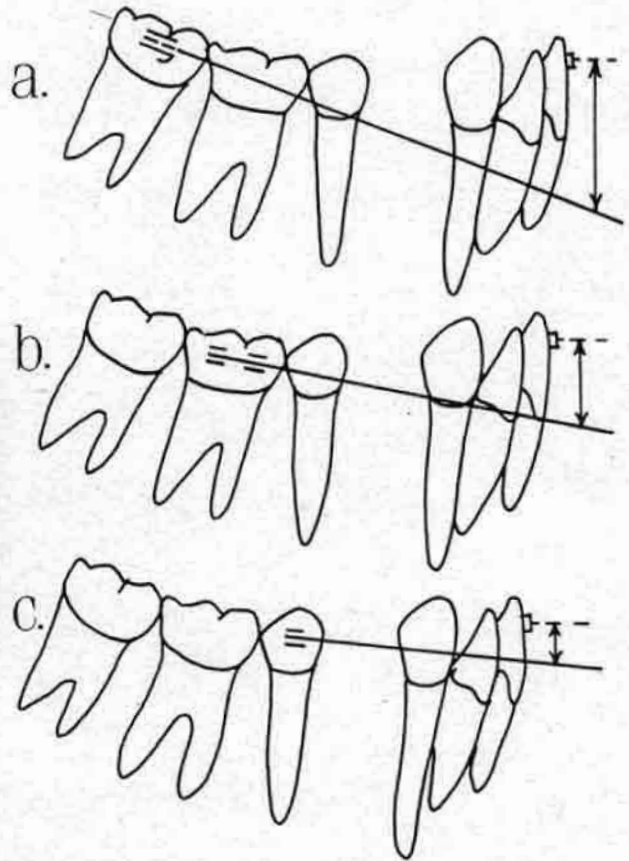


Figure 7. The three mandibular measurements for readout are:

- a. The readout wire placed in the buccal tube of the second molar. The anterior part of the wire is below the occlusal plane. An anterior millimeter measurement is made from the wire to the bracket slot on the central incisor, and recorded as 10-2-7.
- b. The readout wire is then placed in the bracket slot of the first molar, and an anterior millimeter measurement is taken from the wire to the incisor brackets. It is recorded 10-2-6.
- c. The readout wire is then placed in the bracket slot of the second bicuspid, and an anterior millimeter measurement is taken from the wire to the incisor brackets. It is recorded 10-2-5.

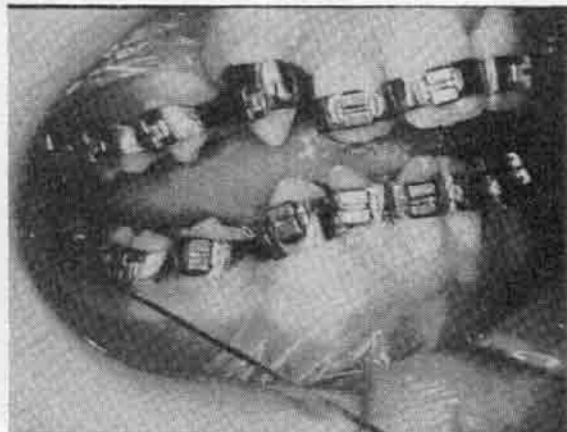


Figure 8a. Readout wire in buccal tube of mandibular second molar.

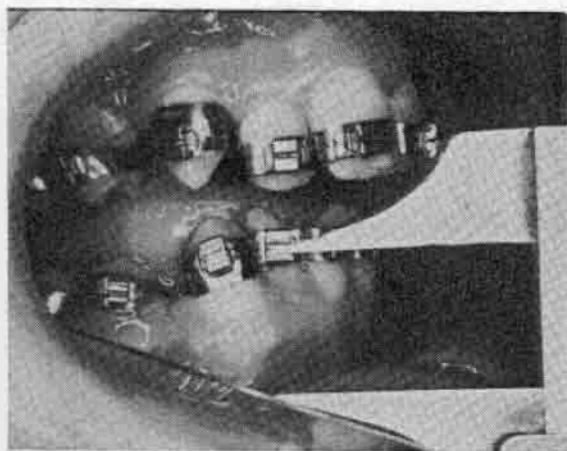


Figure 8b. Anterior measurement with Boley gauge

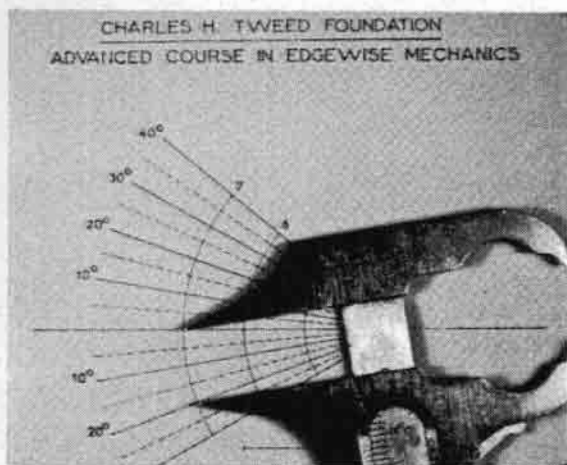


Figure 8c. Millimeter measurement converted to degrees

		READ-OUT					
		RIGHT			LEFT		
		7	6	5	4	3	2
CRANIAL	10						
	2	-20					
LEVELLING	11						
	1						
ARCH: PWD	11						
	1						
FRUSH	11						
	1						

Figure 8d. Measurement recorded on readout sheet

twenty-five millimeters; and the distance from the lower second molar tube to the lower anterior bracket averages thirty-five millimeters. These averages were determined after measuring many cases, and are considered accurate.

Figure 6 shows the wire configuration to make readout measurements. It is a straight piece of rectangular wire, with a handle and a slight offset to slide it into the buccal tube with ease.

Figure 7 diagrams the three measurements taken. Readout is performed intraorally by placing the readout wire in the buccal tube of the lower second molar. The distance is measured in millimeters, from the central incisor bracket slot, to the wire and is recorded in the column under 7 on the readout card. It measures minus twenty degrees and indicates that the second molar has a mesial tip of twenty degrees to the occlusal plane (Figure 8).

The readout wire is then placed in the lower first molar bracket. The distance from the wire to the central incisor bracket slot is measured, and recorded under column 6 on the readout card. The measuring procedure is repeated for the mandibular second bicuspid and recorded under column 5 (Figure 9). These measurements are repeated on the opposite side of the arch. Negative degrees indicate mesially inclined teeth, while positive measurements are for distally inclined teeth (Figure 10). The same procedures are used for the maxillary posterior teeth with the steps diagrammed in figure 11.

Figure 12 shows the readout wire in the



Figure 9a. Readout wire in mandibular first molar bracket



Figure 9b. Readout wire in mandibular second bicuspid bracket

		READ OUT					
		RIGHT			LEFT		
		7	6	5	4	3	2
ORIGINAL	U						
	L	-20	-15	-10	-5	-15	-22
LEVELLING	U						
	L						
ARCH PREP.	U						
	L						
FINISH	U						
	L						

Terminal Read Out: -10 to 0
 0 to 20
 20 to 40
 40 to 60

PATIENT

Figure 10. Readout chart of mandibular arch measurements

buccal tube of the maxillary second molar, in the bracket of the maxillary first molar, and in the bracket of the maxillary second bicuspid. In the second molar, the wire is occlusal to the occlusal plane indicating a distally inclined tooth, and is recorded as a

positive figure. The first molar and second bicuspid show the wire to be gingival to the central incisor bracket slot, so these teeth are mesially tipped and recorded as negative degrees. The measurements are noted on the data sheet:

- a. Both maxillary second molars were tipped ten degrees to the distal and thus recorded plus ten degrees.

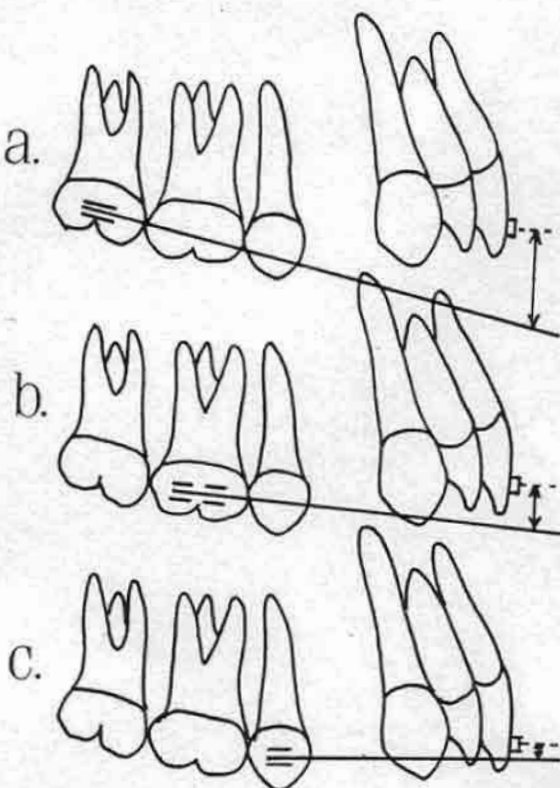


Figure 11. The three maxillary measurements for readout are:

- a. The readout wire is placed in the buccal tube of the second molar. The distance from the central incisor bracket to the wire is measured and transferred to line number seven for a reading in degrees.
- b. The readout wire is then placed in the bracket slot of the first molar. The distance from the central incisor bracket to the wire is measured and transferred to line number six for a reading in degrees.
- c. The readout wire is then placed in the bracket of the second bicuspid. The distance from the central incisor bracket to the wire is measured and transferred to line number five for a reading in degrees.

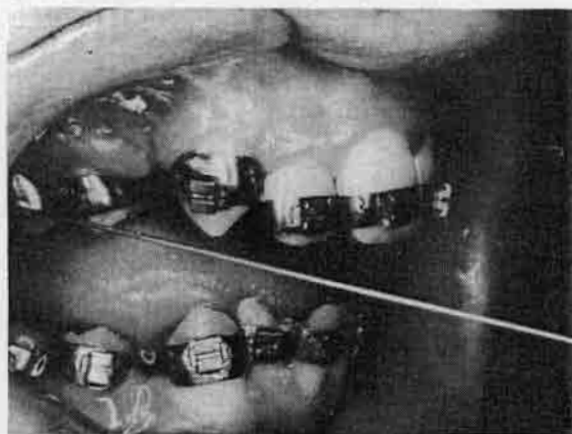


Figure 12a. The wire in the buccal tube of the second molar



Figure 12b. The wire in the first molar bracket



Figure 12c. The wire in the second bicuspid bracket

		READ OUT					
		RIGHT			LEFT		
		7	6	5	5	6	7
ORIGINAL	U	10	-3	-5	-5	-5	10
	L	-20	-15	-10	-8	-15	-22
LEVELLING	U						
	L						
ANCH PREP	U						
	L						
FINISH	U						
	L						

Figure 13. Readout chart with the original maxillary measurements

		READ OUT					
		RIGHT			LEFT		
		7	6	5	5	6	7
ORIGINAL	U						
	L						
LEVELLING	U						
	L						
ANCH PREP	U						
	L						
FINISH	U						
	L						

Figure 14. Recording for mandibular anchorage preparation

- b. Both maxillary first molars were mesially tipped and recorded as minus three degrees for the right side and minus five degrees for the left side.
- c. Both second bicuspids were mesially tipped five degrees and so recorded as minus five degrees (Figure 13).

The readout data sheet has recording space for pretreatment, leveling, anchorage preparation and finishing stages.

Mandibular Anchorage Preparation

Since mandibular anchorage preparation is a vital part of treatment and a very important part of the readout system, its preparation will be described along with recommended tips to the teeth. The anchorage preparation recording area for the mandibular arch is shown in figure 14.

With the use of the readout measurement card, it is easy to place a tip in a wire with a known degree, as registered to the occlusal plane. Figure 15a shows the readout chart

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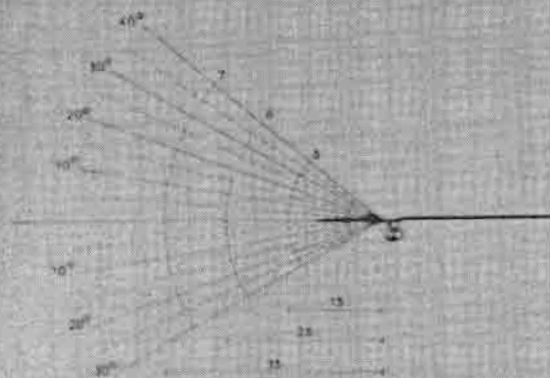


Figure 15a. Readout chart with wire parallel to occlusal plane

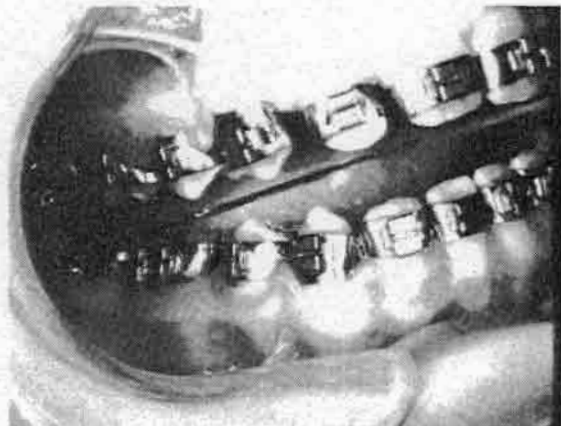


Figure 16a. Readout wire in buccal tube

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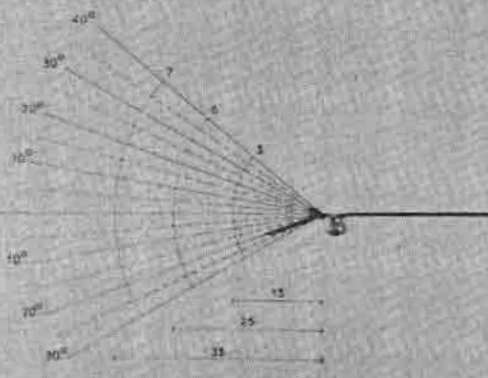


Figure 15b. Readout chart with wire tipped twenty degrees to the occlusal plane.

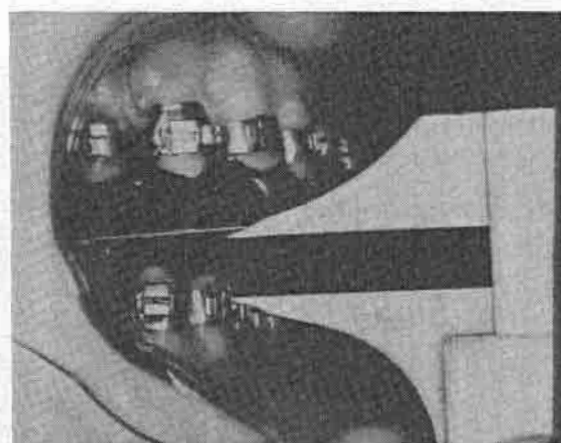


Figure 16b. Measurement with Boley gauge

with a wire on it parallel to the occlusal plane while figure 15b shows the terminal part of the wire tipped distally twenty degrees. In preparing terminal molar anchorage the tip in the wire distal to the loop stop is increased with each wire adjustment a prescribed amount, until the tooth is distally tipped fifteen degrees.

It takes a twenty degree tip in the wire to produce fifteen degrees of tipping to the tooth. Figure 16 shows the distal tip to the terminal molar with a readout wire in place. The wire in the anterior part of the mouth is occlusal to the occlusal plane, indicating

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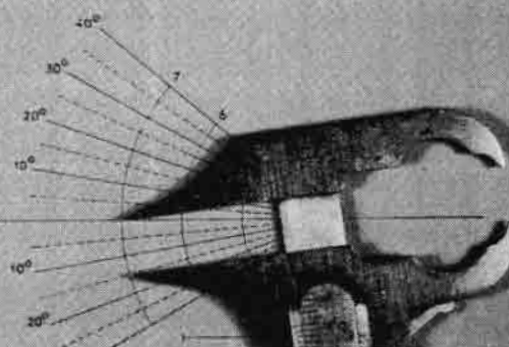


Figure 16c. Readout chart converts the measurement to degrees

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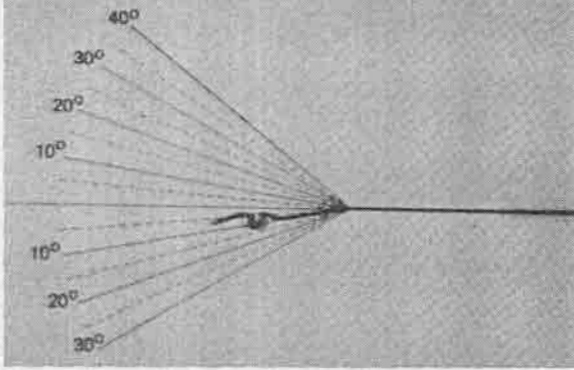


Figure 17a. Diagram of a first molar ten degree distal tip, with a compensating bend to maintain the distally tipped second molar.



Figure 19a. Readout; case with appliances, pretreatment

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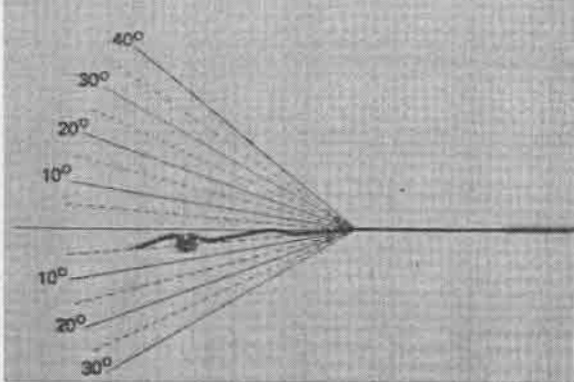


Figure 17b. Diagram of a second bicuspid five degree distal tip, with compensating bends to maintain the first and second molars.



Figure 19b. Readout; case after mandibular anchorage preparation

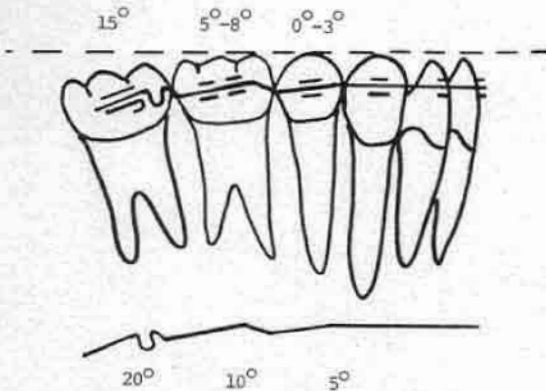


Figure 18. Recommended measurements for mandibular arch

a distally tipped tooth. The amount this wire is above the occlusal plane, is measured from the wire to the central bracket slot. This millimeter measurement is converted to degrees on the readout chart and shows a reading of plus fifteen degrees. The fifteen degree distal tip is the anchorage that is very adequate to support class two elastics.

After terminal molar anchorage is prepared, it is necessary to modify the second order bends when tipping the first molars and second bicuspid. A compensating bend must be placed to maintain the previously tipped tooth's position (Figure 17).

Figure 18 diagrams ideal positions for the mandibular arch after the posterior teeth have been tipped. The terminal molar reads fifteen degrees of distal tip, the first molar

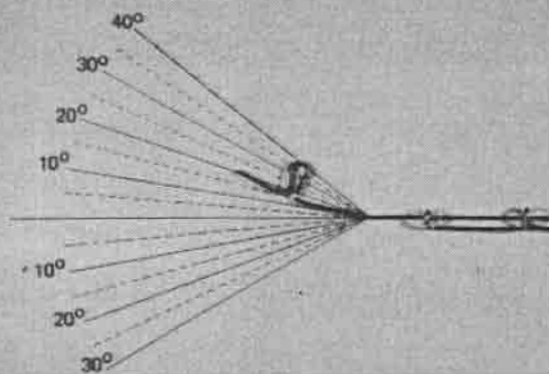


Figure 20. Thirty degree maxillary terminal molar tip

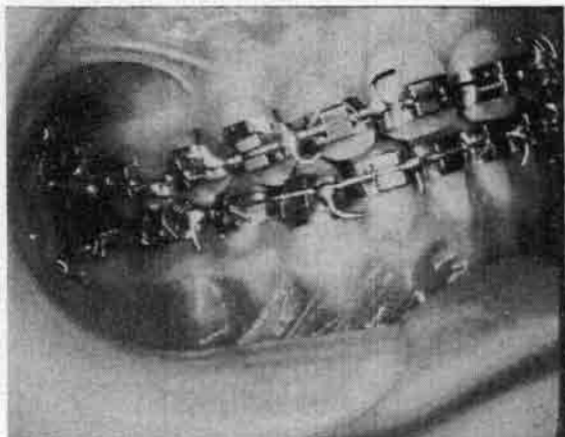


Figure 23a. Case with finishing wires right side



Figure 23b. Case with finishing wires left side

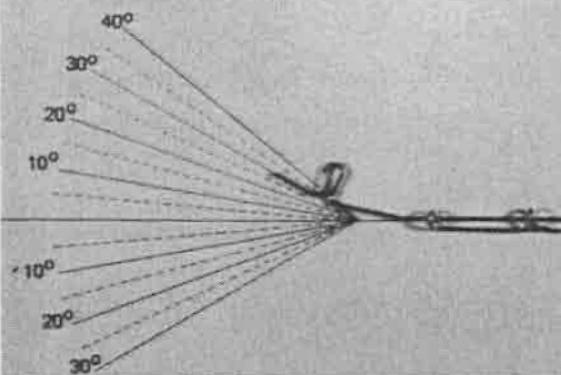


Figure 21. Fifteen degree maxillary first molar tip

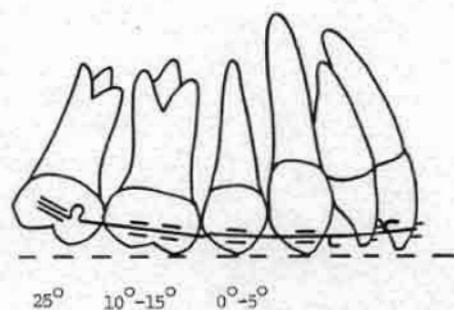


Figure 22. Range of ideally tipped maxillary posterior teeth

ranges five to eight degrees of distal tip, and the second bicuspid ranges zero to three degrees; all measured to the occlusal plane. The wire diagram in figure 18 shows the amount of wire tip it takes to produce the tooth tip.

Figure 19a demonstrates the case used for the original readout procedures after banding and figure 19b shows the same case after proper mandibular anchorage has been prepared. When this procedure of anchorage preparation has been completed to the ideal specification, it must be maintained throughout treatment.

Maxillary Arch Treatment

The maxillary arch should also be monitored with readout from the placement

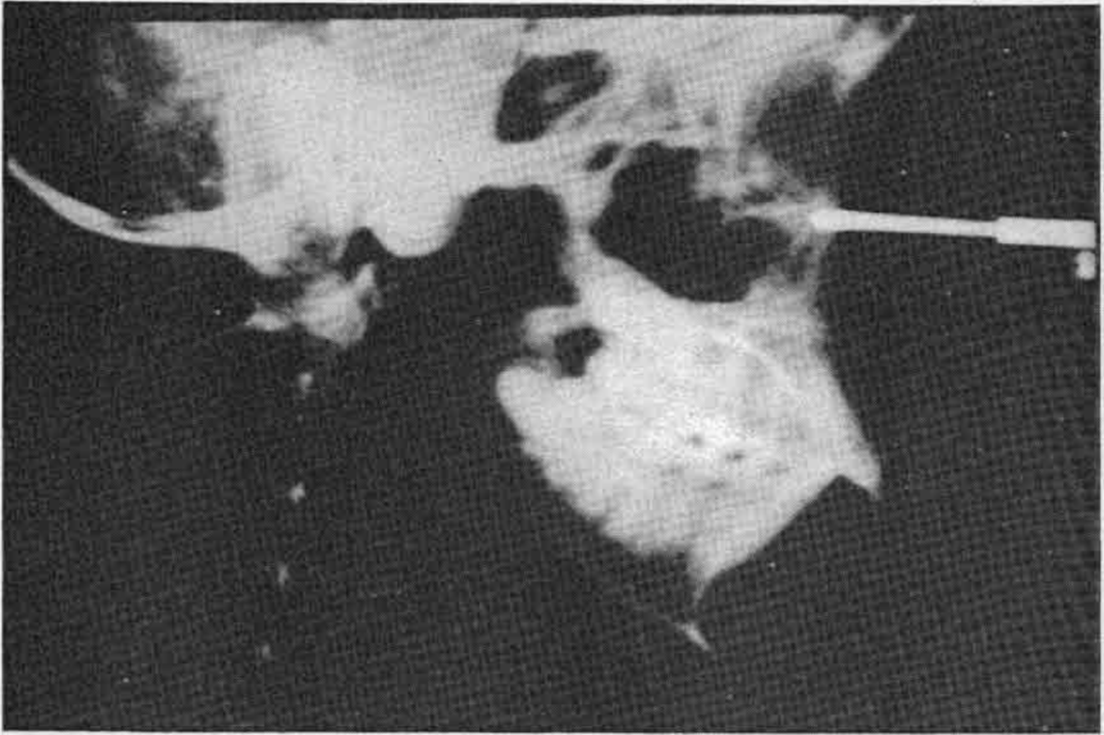


Figure 24a. Pretreatment cephalometric x-ray

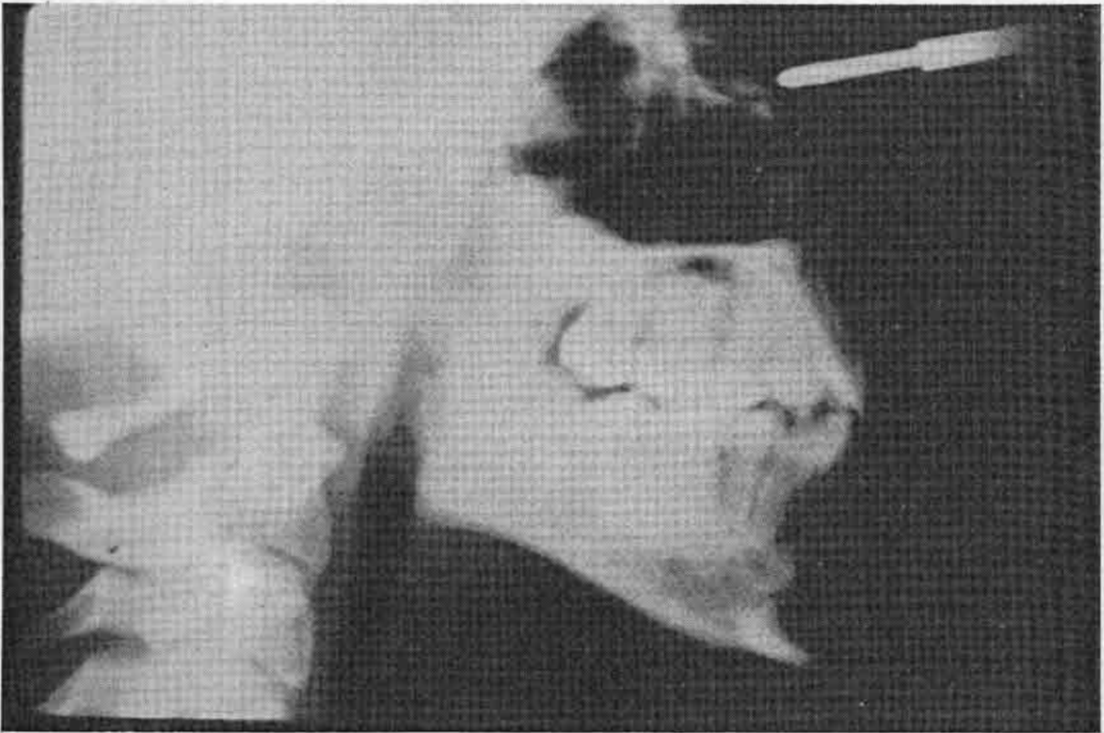


Figure 24b. Posttreatment cephalometric x-ray

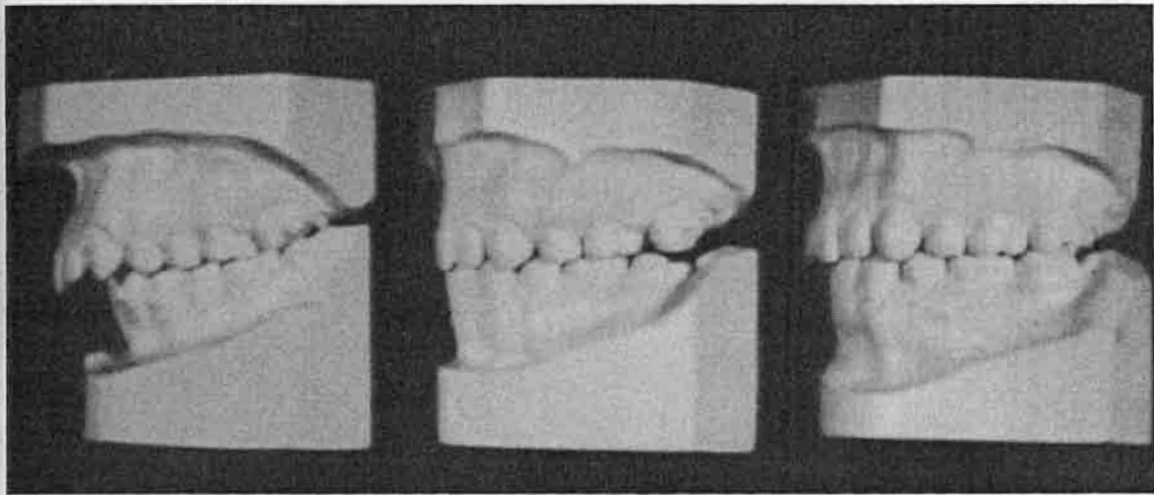


Figure 25. Model comparison showing pretreatment, posttreatment and recovery



Figure 26a. Intraoral right side two years after treatment
 b. Intraoral anteriors two years after treatment
 c. Intraoral left side two years after treatment

of the initial wire to the finishing wires. The procedure of putting second order bends for the terminal molars, into the wire and measuring with the degree card is identical to the mandibular arch. Figure 20 shows a thirty degree terminal molar distal tip, related to the occlusal plane. Figure 21 depicts fifteen degrees of distal tip to the first molar also related to the occlusal plane. There is a definite measured tip to the terminal molar, but the amount of tip to the maxillary second bicuspid and first molar is expressed through a mild curve of Spee. Figure 22 diagrams the maxillary tipped teeth showing the range of ideally tipped posterior teeth. The second molar is tipped distally

twenty-five degrees to the occlusal plane. The first molar is tipped distally a range from ten to fifteen degrees to the occlusal plane and the second bicuspid is tipped distally a range from zero to five degrees.

Once the case has been overtreated to Tweed occlusion, finishing wires (Figure 23) are fabricated to maintain all the distal tips in both the maxillary and mandibular arches.

After finalizing, idealizing, and proper cusp seating, the appliance is removed and the case put into retainers for recovery. Figure 24 shows how the distally tipped teeth in the posttreatment cephalometric x-ray compare to mesially tipped posterior teeth in the pretreatment cephalometric



Figure 27a. Pretreatment facial photographs



Figure 27b. Posttreatment facial photographs

x-ray. Figure 25 shows a model comparison between pretreatment, posttreatment, and recovery two years later. Figure 26 shows the intra-oral relationship of how the teeth have settled with function after two years of recovery and figure 27 demonstrates the facial change that can be expected with this type of treatment.

Readout is a very effective and easily used

clinical procedure for monitoring all second order tooth movements of orthodontic treatment. This control makes it possible to place the posterior teeth to a pre-determined position, with consistency.

3621 N.W. 63rd Street
Oklahoma City, OK 73116