



LEAF GAUGE TECHNIQUE

AUTHOR

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Introduction

The primary purpose of a leaf gauge is to allow the antero-superior seating of the mandibular condyles. The intended position, of course, involves the interposition of the discs between the condyles and the posterior surface of the articular eminences. This position is attained through the action of the superior head of the lateral pterygoid muscles (anterior component) and the temporalis muscles (superior component) (Figures 1-4).

When no posterior teeth are in contact and utilization of the leaf gauge is correct, the electromyographic studies indicate that these muscles are primarily involved.¹ Recent anatomical research indicates that most fibres of the superior head of the lateral pterygoid insert into the anterior part of the mandibular condyle. Some fibres also insert into the articular disc but not the majority as previously assumed.²

It is significant that this seated position appears to be utilized on the working side when individuals chew tough or hard foods.³ The movement of

the working condyle involves the translation anteriorly from the intercuspal position, lateral rotation towards the working side, and backward translation with the condyle slightly distracted from the surface of the eminence. It then seats antero-superiorly and medially through the seated position and back down to the position dictated by the intercuspal relationship of the teeth (Figures 5-7). For some individuals, the distance from the seated position to that of maximum intercuspation is small (Class I) and for some it is large (Class II).⁴

It would seem that the greater the distance, the greater the stress in the joint. It is the author's opinion that most temporomandibular joint injuries, like most injuries to other joints, are the result of stress and strain. In treating occlusal relationships, it seems prudent to assess the seated position and to attempt to treat it whenever possible to eliminate potential post-treatment functional stress in the joints. Hence, the purpose of the leaf gauge use.

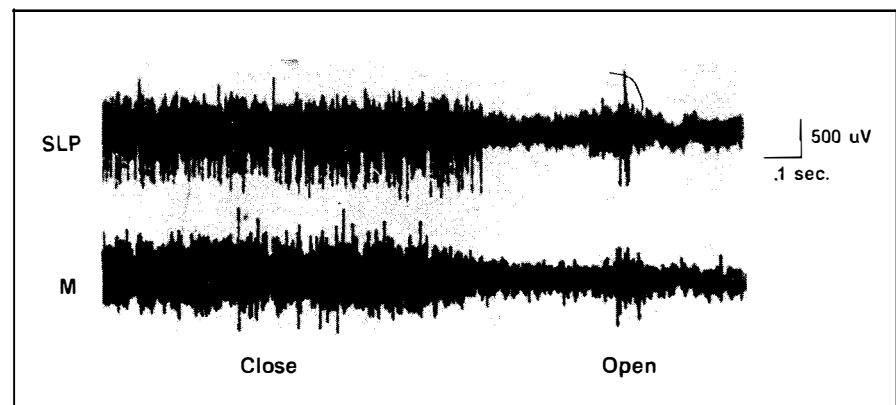


Figure 1. Electromyographic records from the superior head of the lateral pterygoid (SLP) and masseter (M). Note that both muscles are active on closure and quiet on opening.

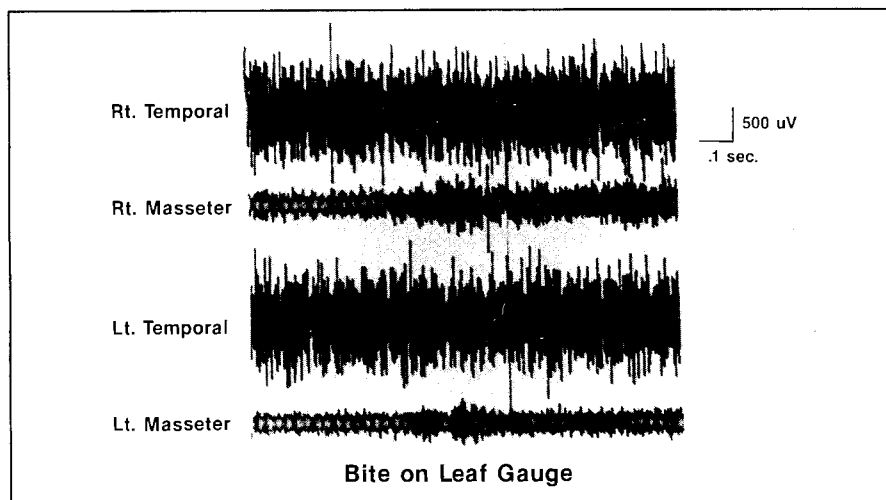


Figure 2. Electromyographic records showing bilateral activity as the temporalis seats the condyles and, thereby, determines the mandibular position. The patient is holding a leaf gauge between the incisors and attempting to close simultaneously on the posterior teeth of both sides. Note that the temporalis is involved primarily in seating the condyle when no posterior teeth are in contact.

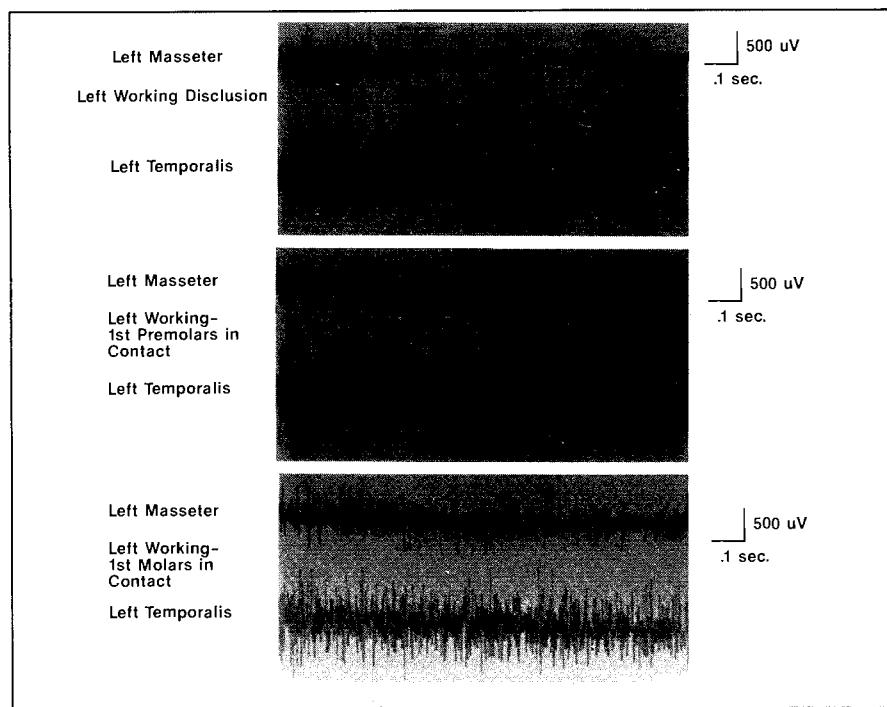


Figure 3. Electromyographic records from the left masseter and temporalis. The temporalis is active during ipsilateral working excursions, regardless of the occlusal scheme. However, note the following: (A) With disclusion after a left working excursion from the seated position, the masseter becomes quiet as soon as the posterior teeth are discluded. (B) Given premolar contact during a working movement, the masseter continues to be very active as long as the premolars are in contact. (C) When the molars are in contact on the working side, the masseter continues to be active as long as they are in contact, loading the joint.

Leaf Gauge Procedure

1. Manipulate the mandible by placing the index and second fingers on the inferior surface of the right and left gonial angles. Place the thumb of the same hand on pogonion. With upward pressure on the gonial angles and downward pressure on

pogonion, "rotate" the mandible to the seated position as best as possible. Have the patient close from that position to first tooth contact while you continue to manipulate the mandible. Assess the amount of space between the maxillary and mandibular incisor teeth.

2. Select the approximate number of leaves needed to fill the space between the maxillary and the mandibular incisors and add a few more leaves in order to separate all the posterior teeth.
3. Place the leaf gauge with the selected number of leaves between the incisor teeth. Place a thumb on the posterior teeth of one side and the first finger on the teeth in the second molar area of the opposite side. While tapping the mandibular molars, ask the patient to: "try to bite on the back teeth on both sides at the same time".
4. Remove the fingers from the mouth and stand behind the patient. Place the tips of the fingers on the middle to posterior fibres of the temporalis muscles bilaterally. If the patient is biting correctly, you should feel the bulging contraction of the muscles simultaneously. You should not be able to feel the masseter muscle contracting with force. You may, however, feel some tonic or mild quivering activity.
5. Ask the patient to place his fingers on the temporalis muscles bilaterally above the ears. He should use the tips of his fingers and press firmly. At the same time, the patient may place his thumbs on the masseter muscles. Explain to the patient that contractions should be felt from the temporal but not the masseter muscles if he is biting correctly. This proprioceptive feedback is very important to the patient. If he can feel the muscles contract properly, he will be able to repeat the technique routinely.
6. Tell the patient to: "squeeze and relax, squeeze and relax" and to bite with moderate pressure. He should not bite hard except initially to be able to feel muscle contraction. If he bites continually without relaxation, fatigue will develop and pain will be elicited. Biting hard on the leaf gauge also may sublux the condyles, particularly in deep-bite individuals.
7. If the patient can complete this procedure for five minutes without touching the teeth, an interocclusal record may be made. The mandible is assumed to be in the seated position for that patient at that appointment. If the teeth begin to

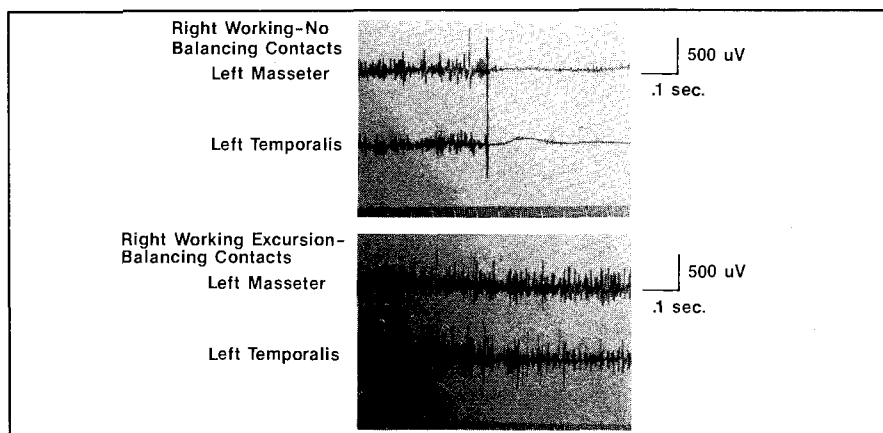


Figure 4. Electromyographic records taken from the left masseter and temporalis while a right working excursion is executed. Accordingly, they would be non-working (balancing side) muscles. (A) Note that given a disclusion of the posterior teeth from the seated position by means of the right canines and incisors, the left temporalis and masseter immediately become silent. (B) When a small piece of gauze is placed between the left molars, the masseter and temporalis continue to be active as long as the contact with the gauze is maintained, again, loading the joint.

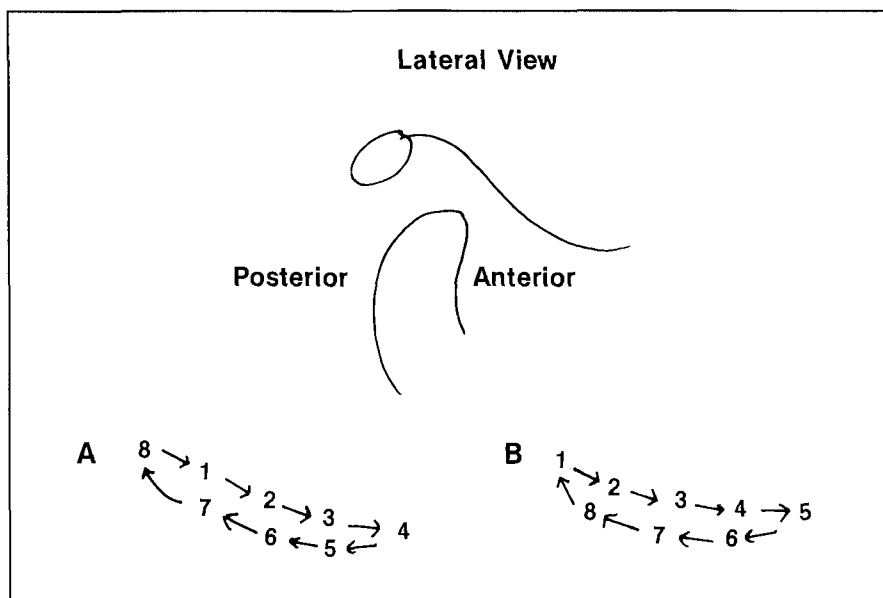


Figure 5. Typical working condylar path tracked while chewing hard food (after Lundeen and Gibbs). (A) There is potential tooth contact between #8 and #1. Therefore, muscle activity is increased and excessive loading of the joint results. (#1 is I.P. #8 is most superior position). (B) Ideal chewing stroke with #1 as the most superior condylar position and I.P. concomitantly. The superior head of the lateral pterygoid muscle and the temporalis muscle are primarily responsible for placing the working condyle superior and anterior on the eminence.

contact (usually second molars or first premolars), a few more leaves may be added and the patient asked to continue the procedure. This indicates that the condyles have continued to seat as the temporalis and superior heads of the lateral pterygoids function.

Interocclusal record

It is important to make the interocclusal record at as closed as a

vertical dimension as possible but just prior to first tooth contact. Therefore, leaves are removed until the articulating paper begins to "drag" through the contacting cusps. The first contact then is marked and noted. It should be identical to the first tooth contact on the mounted models and may be used as a test to assure proper mounting. After the first tooth contact is noted, two or three leaves are added to open the vertical dimension slightly, and the patient is

allowed to squeeze and relax for two or three minutes. This will allow deprogramming of the muscles following tooth contact.

A recording of the jaw relationship is made then with zinc oxide-eugenol paste placed on a thin fibreglass mesh and support with a wire frame. The mandible is left slightly open to prevent occlusal reflexes from moving the jaw forward into centric occlusion. The author prefers this method to a wax recording because the zinc oxide-eugenol is semifluid when it is inserted in the mouth and, thus, generates minimal reflex feedback from the teeth. It is also the most efficient method for utilizing auxiliary personnel.

Trouble Shooting with the Leaf Gauge

Problem:

Masseter muscles heavily contracting.

Solution:

1. If the patient is contacting posterior teeth, add leaves to the leaf gauge.
2. If the patient is protruding the mandible against the leaf gauge, he is attempting to bite against the leaf gauge rather than trying to bite on the posterior teeth. Have the patient retrude the mandible.
3. If the patient is brachyfacial with a square-jawed appearance and a low mandibular plane angle, the patient may have difficulty achieving proper temporalis and masseter function. It may require extra time to train the patient.

Problem:

Extreme open-bite patients.

Solution:

Use two leaf gauges and then take a wax interocclusal record.

Problem:

Severe retrognathic patient and leaf gauge is resting on the palatal tissue as the lower incisors close on it.

Solution:

This will cause no problem with leaf gauge use.

Problem:

Patient with end-to-end incisors or Class III.

Solution:

Use a wax interocclusal record.

Problem:

Anteriorly dislocated discs.

Solution:

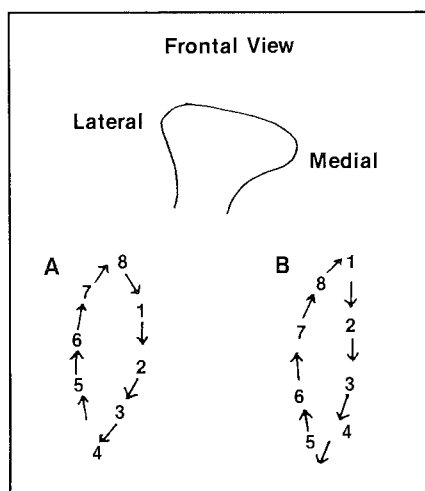


Figure 6. A typical working side condylar path tracked while chewing hard foods – normal occlusion (after Lundeen and Gibbs). Distance between recording points is 50 msec. (A) Contacts may occur between #8 and #1. Therefore, there would be muscle activity and loading of the joint. (#1 position is I.P. #8 is most superior position). (B). Ideally, #1 should be both the most superior and I.P. position simultaneously. Then the anterior guidance would separate posterior teeth from #1 position through #8 position. Muscle activity would be at a minimum and very little loading of the joint would result.

If the patient is in pain, do not use a leaf gauge for the recording. It is best to use light manipulations and a wax record. The mandible obviously is not in centric relation since the disc is displaced. The mounting achieved is only a record of where treatment began.

Comments

With adolescent and asymptomatic adult patients, the leaf gauge position usually will be very close to the position of the mandible following superior repositioning splint therapy. With symptomatic cases, the leaf gauge positioning is adequate for the patient at that particular appointment. Superior repositioning splint therapy, however, is

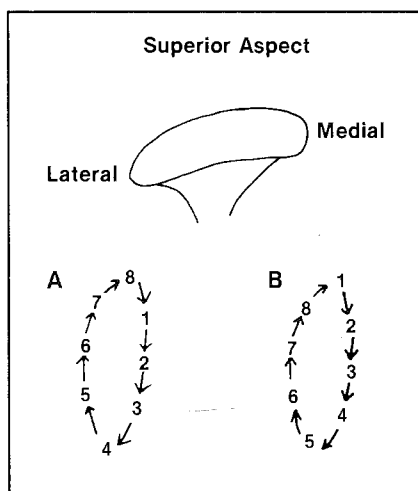


Figure 7. (A). Typical working side chewing stroke. #1 is I.P. Potential tooth contact may result from #8 to #1. (B). Ideal chewing stroke with #1 as I.P. and the seated position concomitantly.

necessary to allow continual seating until stability is achieved.

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