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Fabrication of a Caliper Device for Interalveolar Dimension Measurement in the Complete Denture Patient

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Abstract

A method is presented for measuring interalveolar dimension (IAD) of existing dentures using a caliper. Directions for construction of an IAD gauge are included. This device is easy to construct and "zeroes out" in the closed position. The measurement is useful for determining occlusal vertical dimension (OVD) in new dentures and for monitoring changes over time. Its dimension is entered in the patient record for future reference.

Determining occlusal vertical dimension (OVD) is a critical step in the occlusal records appointment in complete denture fabrication. The most common methods for determining OVD involve extraoral soft tissue measurements, which have the potential for variation and inaccuracy due to skin movement.[1] In addition, many extraoral measurement techniques cannot be transferred from appointment to appointment because of an inability to create permanent reference marks for the device on the face. Interalveolar dimension (IAD) for edentulous patients is the space between the edentulous ridges at the OVD, measured at specific points.[2] In a set of complete dentures, IAD can be measured from the intaglio surfaces when the dentures are held in centric occlusion.[3] When fabricating replacement dentures, this dimension can be transferred to the record base/occlusal rim and eventually to the new prosthesis.[1,2] A variety of devices have been described for measuring IAD.[2] A device for readily measuring IAD has been developed by the authors and is currently in clinical use at our institution.

Fabrication of the interalveolar caliper

The Boley gauge modification shown in Figure 1 requires some time as well as metalworking skills. An instrument with equivalent capability can also be constructed with readily obtainable commercially available products. The procedure for constructing a simplified version is as follows:

1. Obtain a spring-type caliper ("Yankee" 79A4, L.S. Starrett Co., Athol, MA, available in many hardware and lumber stores or at www.starrett.com).
2. Disassemble the caliper to remove the right and left legs, #1 and #15.
3. Disassembly is accomplished as follows:
   a. Remove screw finish cap #10.
   b. Back off solid nut #11 and washer #10 and remove from inside screw #2.
   c. With tension gone, #8 bow and #9 can be easily removed.
   d. Slide leg #15 off screw #2.
   e. Pull off stud cap #6 and remove stud from leg.
   f. Using a 0.9-mm orthodontic wire or equivalent, tap out pin #7 from stud cap #4. This frees the inside screw.
   g. Remove stud cap #4 and stud from leg.

   The legs are now free to be attached to a Boley gauge.
4. Drill four #6 holes through the two legs as shown in Figure 2.

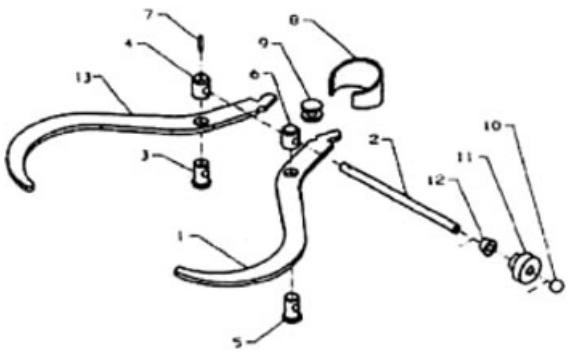

Figure 1 Boley gauge modification: (1) leg (right); (2) inside screw; (3) left stud; (4) left stud cap; (5) right stud; (6) right stud cap; (7) pin; (8) bow; (9) stud, fulcrum; (10) cap, screw, finish; (11) nut, solid; (12) washer for solid nut; and (13) leg assembly (left).

5. Align the legs on the Boley gauge and stabilize in a vise or clamp.
6. Drill four holes in the Boley gauge using the leg holes as guides.
7. Attach the legs as shown with 6-32 bolts and nuts as shown.
8. Instrument is now ready for use.

Measurement technique

In the current technique, IAD measures the inter-ridge distance between the incisive fossa of the maxillary denture and the anterior alveolar groove when the dentures are held in maximum intercuspal position (Fig 3). Due to the presence of flanges on typical dentures, a Boley gauge usually cannot reach into the intaglio surface of an occluded set of dentures. The modified Boley gauge (Fig 2) can reach into the interior points of the dentures. During an occlusal records appointment, the patient's old set of dentures are removed from the mouth, and the IAD is measured while the operator holds the dentures in occlusion (Fig 4). After the wax rims are adjusted to desired incisal length, upper lip support, occlusal plane orientation, and OVD, the measuring device is used to check IAD of the wax rims and to compare with the IAD of the original dentures (Fig 5). Subsequently, at the trial denture and insertion appointments, the device can be used to confirm that the IAD (and consequently the OVD) have not changed during various laboratory phases.

Discussion

One of the main utilities of an IAD measurement device is that the dimension can be recorded in the chart, becoming a permanent data value for the patient.[1] This dimension is checked throughout denture fabrication to avoid uncontrolled changes in OVD.[2] Later, if the patient loses one or both dentures (a common occurrence in nursing facilities), replacement denture(s) can be fabricated with the same IAD. The disadvantage of current soft tissue measurements of vertical dimension of rest position and OVD is that they do not assign permanent, reproducible values for future reference to a patient with verifiable accuracy.[3,4] Assessment of loss of OVD, for example in immediate dentures, may be established with precision using this method, which is the main advantage of this technique over previous methods.[2] The IAD measurement device is easily "zeroed out" in the closed position and is not difficult to read, which is another advantage it enjoys over previous methods.[3]

Clinicians should recognize that this technique involves measurement of IAD using the patient's prostheses, and this value ignores changes that occur in the patient's denture bearing tissues as a result of biologic processes, such as residual ridge resorption.[2] Over the years, this value can be used to estimate vertical changes in the dentures due to artificial tooth wear or relining, but the practitioner should use additional techniques to assess changes in OVD, such as freeway space and speaking space evaluation.[5]

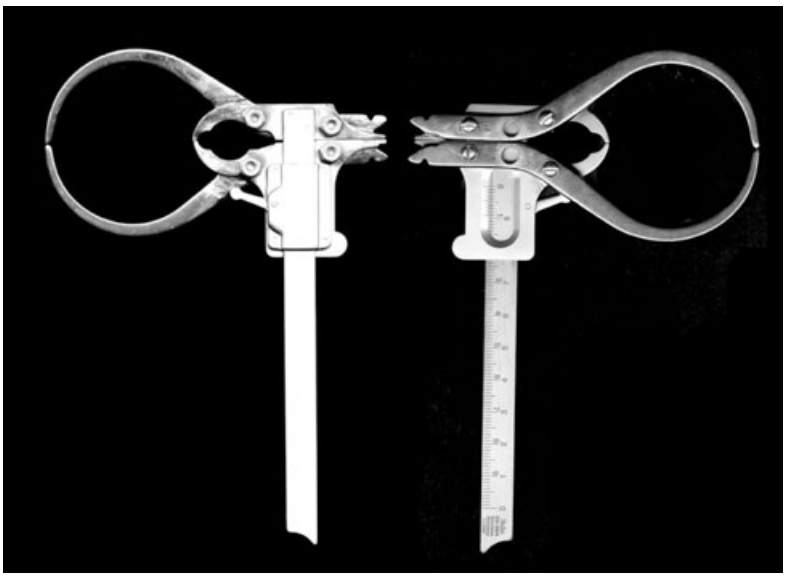

Figure 2 Four #6 holes drilled through the two legs.

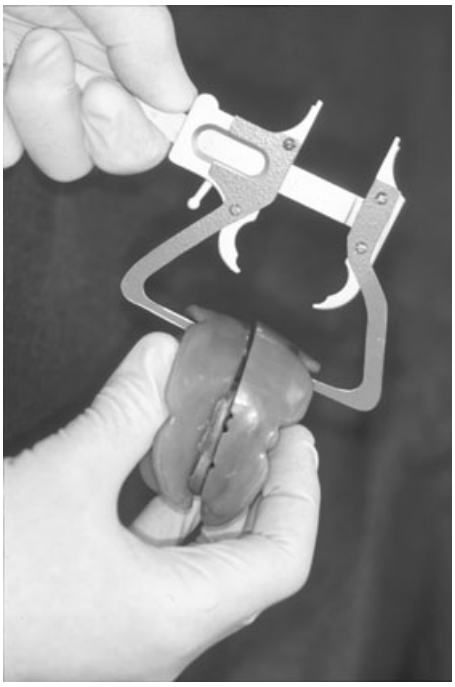

Figure 3 Measuring IAD with Boley gauge.

A distinct limitation of IAD measurement techniques using existing dentures is the lack of application to edentulous patients who have no existing denture, or to candidates for immediate dentures who present with hopeless, nonoccluding natural dentition only. In these cases, OVD is estimated by traditional, extraoral measurements during the occlusal records appointment.[1-3,6] In all cases of newly fabricated sets of dentures, we propose that the IAD be measured and recorded in the chart at the insertion appointment.

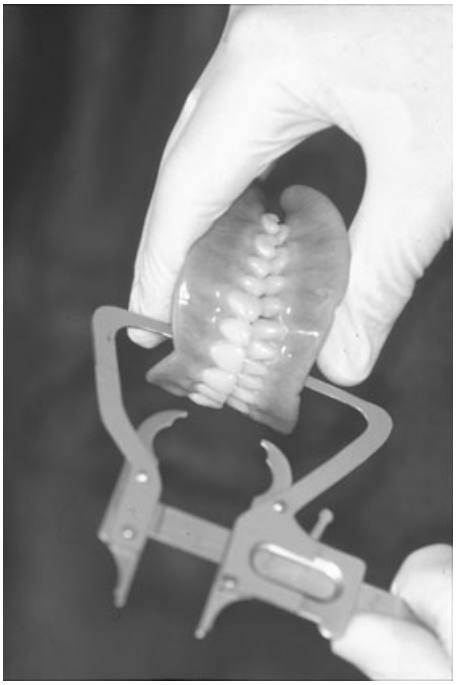

Figure 4 Checking IAD of wax rims at incisive papilla.

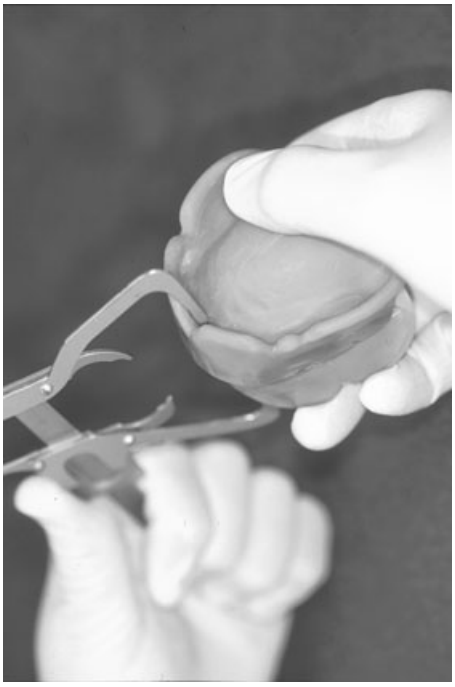

Figure 5 Measuring IAD with denture in maximum intercuspal position.

In educational settings, we feel that the assessment of IAD provides useful additional information about each patient's stomatognathic status. It reinforces basic aspects of vertical dimension and establishes a patient data point for reference by subsequent students and faculty.

Summary

Fabrication of measurement devices to be used for recording IAD using existing dentures in edentulous patients has been presented. The measurement using this device is simple and provides a permanent reference for each patient's individual vertical dimension.

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