Evaluation of the incisive papilla as a guide to anterior tooth position

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The facial structures of edentulous patients offer only indirect clues as to the original position of the natural teeth. Finding the most suitable position for artificial anterior teeth presents a new challenge with every denture and has resulted in a variety of biometric measurements. Many of these measurements relate the denture teeth to points on edentulous casts. The most obvious landmark that appears to have survived intact from the dentate state is the incisive papilla, and it has received a great deal of attention.

Harper suggested that the incisal edges of the upper central incisors should be 5 to 8 mm in front of the center of the papilla. Hickey et al., Martone, Murray, and Mavroskoufis and Ritchie preferred 8 to 10 mm for this measurement, whereas Schiffman related the canines to a line bisecting the papilla. Maritato and Douglas suggested the use of the inner surface of the denture border (which corresponds to subspinale, the cephalometric point A) as a guide in establishing the labial contour of the occlusion rim.

More detailed studies on the changes in the maxillae following the loss of the teeth include the work of Johnson, who found that resorption was quite marked in the region of the alveolar process during the first 3 years. On the lingual aspect, resorption extended distally to involve the anterior part of the palate. Watt and Likeman, by superimposing tracings of serial casts of maxillae during the same period, showed that the incisive papilla migrates an average of 1.6 mm forward and 2.3 mm upward as a result of the remodeling of the region. Only the median region of the palate bounded by a line drawn approximately 10 mm from the lingual gingival margins remained unchanged during the 2½ years. This region is much less convenient for the purpose of quick and easy reference than the papilla itself. Therefore it is common to use the posterior border of the papilla as the part likely to be least affected by the changes in anatomy of the region. Erlich and Gazit found that the labial surface of the central incisor was an average of 12 to 13 mm anterior to this point.

The variety of suggested measurements has led to confusion in this aspect of the fabrication of maxillary complete dentures, and it was hypothesized that dentures are commonly made with the anterior teeth set further back than the natural teeth. This investigation was done to determine whether the mean distance between the posterior border of the incisive papilla and the labial surface of the left central incisor in a group of artificial maxillary dentures would be different from the corresponding mean distance in a group of stone casts of healthy natural dentitions.

METHOD AND MATERIAL

The first test group (group 1) consisted of existing complete upper dentures of 67 patients (34 men, 33 women) attending the Department of Prosthetics of the University of the Witwatersrand for routine replacement of their dentures. The criteria for selecting a denture as suitable for the experiment were that the denture should not be an immediate denture and that the imprint of the incisive papilla should be discernable on the inner surface.

The distance between the labial surface of the left central incisor and the posterior border of the incisive papilla will be referred to as measurement A. This measurement was recorded for comparison of the means between the experimental group 1, and the control group of casts of natural healthy dentitions, group 2. The stone casts of group 2 were poured under standard conditions from irreversible hydrocolloid impressions of the maxillary teeth of a group of 60 young Caucasian adults (35 men, 25 women), none of whom had evidence of periodontal disease or missing anterior teeth.

Standardization of the measurement was complicated by the fact that measurement A was the distance between points on different horizontal planes, with the result that parallax error was likely to be introduced if the measurement was effected with different tilts of the measuring device. Repeatability was greatly improved by controlling the measuring gauge so that it was approximately parallel to the occlusal plane. This was achieved by mounting the gauge on the spindle of a Ney surveyor (J.M. Ney Co., Hartford, Conn.) so that its body was parallel with the stage. Measurements of A on a denture placed teeth down on the stage of the surveyor (Fig. 1) were thus close to being in the same plane as measure-
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Table I. The mean measurements of the groups divided according to sex and nature

<table>
<thead>
<tr>
<th>Factor</th>
<th>Group</th>
<th>Mean (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>12.46</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>11.96</td>
</tr>
<tr>
<td>Nature</td>
<td>Artificial</td>
<td>11.39</td>
</tr>
<tr>
<td></td>
<td>Natural</td>
<td>13.17</td>
</tr>
</tbody>
</table>

Table II. The measurement means and standard deviations of the two sample groups with the sexes segregated

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Sex</th>
<th>Mean (mm)</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Artificial)</td>
<td>Male</td>
<td>11.41</td>
<td>2.41</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>11.36</td>
<td>1.73</td>
<td>33</td>
</tr>
<tr>
<td>2 (Natural)</td>
<td>Male</td>
<td>13.49</td>
<td>1.56</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>12.74</td>
<td>1.29</td>
<td>25</td>
</tr>
</tbody>
</table>

ments of A on a cast that had been inverted on the same stage (Fig. 2), provided that the base of the cast had been trimmed to be approximately parallel to the occlusal plane. To deal with the difference in the horizontal planes of the reference points, the gauge was modified by shortening the anterior beak by 8 mm and grinding it to a fine point.

The mean of three readings of measurement A for each specimen was recorded. Statistical analysis included an analysis of variance for unbalanced samples.1 The level of significance was set at 1%, and an IBM 4381 mainframe computer was used with the BMDP statistical software package.

RESULTS

Table I shows the means of measurement A for the groups divided according to sex and also according to its nature, namely the sample of dentures (artificial) or the control sample of natural dentitions (natural). In Table II, the groups are further subdivided to show the sexes within the groups of artificial and natural teeth, detailing the means of measurement A, the number in each subgroup, and the standard deviations. In a two-way analysis of variance, the factors sex (male and female) and nature (artificial and natural) were analyzed. The sex factor was found not to be significant ($p = .2250$) whereas the nature factor was significant ($p < .001$) and the interaction between the factors of sex and nature was not significant ($p = .2857$). In particular, the mean length (mm) for the group with artificial teeth was found to be significantly smaller than that for the group with natural teeth (Table I).

DISCUSSION

The results indicate that measurement A was significantly smaller in the sample of dentures than in the control group of natural dentitions. If the samples are accepted as representative of the Caucasian population as a whole, this suggests a tendency for the maxillary anterior teeth of artificial dentures to be set closer to the posterior border of the incisive papilla and therefore further back than the natural teeth. This tendency probably originates from the belief that the teeth should be set on the ridge to reduce the unfavorable leverages that tend to dislodge a denture. Pound condemned this tendency as being the most common cause of the so-called denture look, the artificial appearance that is an unfortunate feature of many prostheses.

Placing the artificial teeth so as to convey the most natural appearance may be regarded as an expression of the artistic talent of the dentist. Boucher et al. states that the position and expression of the lips and lower part of the face are the best guides, all others being secondary. Absolute accuracy in reproducing the position of the natural predecessors might not necessarily be desirable for prosthetic anterior teeth. The changes in bone and muscle structure that occur after the loss of the dentoalveolar processes may produce physiologic changes and different requirements for edentulous individuals, compared with those with natural teeth.
The usefulness of the incisive papilla as a reference point is limited because of the migration and change of shape it has been shown to undergo. However, it may serve some purpose because it is an easy measurement to make. This study supports the findings of Erlich et al. that an acceptable value for the measurement A should be 12 to 13 mm. No differentiation for the sexes seems to be necessary. The usefulness of a preextraction record such as a diagnostic cast of the natural teeth is emphasized by the difficulty, encountered in this study, in recapturing the information that is lost in the edentulous situation. Dentists providing immediate dentures should make these records and advise their patients to keep them safely for reference when having their dentures replaced.

SUMMARY

The incisive papilla provides a reference point on the edentulous cast that may be helpful in determining the anteroposterior position of the artificial incisors. The results of the study suggest that the labial surface of the maxillary incisors should be 12 to 13 mm from the posterior border of the incisive papilla. This measurement was significantly smaller in the sample of dentures examined, which suggests a tendency for the anterior teeth to be placed too far posteriorly in artificial dentures.

REFERENCES