created that cannot be used effectively for the support, retention, and stability of an intended prosthesis, little benefit is provided for the patient. Small variations in intended treatment can significantly increase success of the prosthesis (Fig. 13). Unfortunately, the relative ease of hydroxyapatite placement has led to its use in patients who do not require augmentation and augmentation in amounts and regions that are not conducive to improving denture success. A coordinated effort between the surgeon and the prosthodontist will usually result in treatment that provides the best potential foundation for a specific patient.

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The influence of impression trays on the accuracy of stone casts poured from irreversible hydrocolloid impressions

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Many factors can cause distortion in irreversible hydrocolloid impressions and subsequent inaccuracies in artificial stone casts. Dental materials or the dentist’s impression techniques are frequently blamed for discrepancies between oral tissues and stone casts. However, little attention is given to the possibility of distortion being produced by using an inadequate impression tray.

Different opinions exist concerning the selection of a suitable tray for irreversible hydrocolloid impressions. The objective of this study was to identify which of four commonly used impression trays helps make the most accurate irreversible hydrocolloid impression. This objective was achieved by determining the comparative accuracy of artificial stone casts that were obtained from irreversible hydrocolloid impressions made in trays with different characteristics.
Fig. 1. Master cast after being trimmed, polished, and treated with model-finishing soap.

Fig. 2. Fine, sharply defined pit was engraved on metal plate and flattened surface of each metal crown.

Fig. 3. Four impression trays tested were stock Rim-lock nonperforated, stock perforated, custom nonperforated with spacer, and custom perforated with spacer. Note that all impression trays have three acrylic resin stops at same locations.

LITERATURE REVIEW

The literature is replete with discussions of the various types of impression trays used in making irreversible hydrocolloid impressions and the procedures used to improve or modify them. Emphasis has been given to the significant influence that the tray form has on the amount of impression distortion. Several authors have recommended the use of perforated impression trays. Some researchers have suggested the use of Rim-lock (L. D. Caulk Co., Milford, Del.) nonperforated trays, while others prefer Rim-lock perforated trays. The use of plain and perforated custom trays has also been advocated. Recommendations to customize impression trays, to use adhesives, or to use other means of retention have also been made.

MATERIAL AND METHODS

A specially prepared stable cast (master cast) was used in this investigation. The master cast was made in improved artificial stone (Silky Rock, Whip Mix Corp., Louisville, Ky.) with five cobalt-chromium crowns (Vitallium 2 alloy, Howmedica, Inc., Chicago, Ill.) and a square plate (Fig. 1). The crowns were designed with a flat plane. The plate and flat planes of the crowns were marked by means of a punch. The engraved marks consisted of fine and sharply defined pits (Fig. 2).

Complete irreversible hydrocolloid impressions of the master cast were made using four different kinds of trays (Fig. 3): (1) stock Rim-lock nonperforated tray (NWC Caulk Rim-Lock impression tray, regular, U11), (2) stock perforated tray (COE impression tray, extra long orthodontia style, XL5, COE Laboratories Inc., Chicago, Ill.), (3) custom tray with spacer, nonperforated, and (4) custom tray with spacer, perforated. Perforations were at approximately 2.5 mm intervals and 2 mm in diameter.

Although the placement of stops in stock trays is not a common clinical procedure, stops were used to minimize variables. The custom trays were made of autopolymerizing acrylic resin (Ontray, self-curing plastic, Teledyne Dental, Elk Grove Village, Ill.) by the adapting technique. The two trays were fabricated with identical clearance (approximately 3 mm) and with stops.

The proportions and temperatures used in mixing the materials were 57 ml water at 70°F to 19.5 gm powder for the irreversible hydrocolloid (Caulk Jeltrate, alginate impression material, Type II regular, normal set, batch No. 020378 3, L. D. Caulk Co.), and 58 ml water at 70°F to 200 gm powder for the artificial stone (Quickstone,
buff, serial No. 0205824, Whip Mix Corp.). Double-distilled water was used throughout. Because adhesives (Hold spray-on tray adhesive, Teledyne Dental) for irreversible hydrocolloid impressions are extensively used, they were applied to both nonperforated impression trays in every instance.

Ten impressions were made with each type of tray. They were coded as follows:

- Stock Rim-lock nonperforated: A
- Stock perforated: B
- Custom nonperforated: C
- Custom perforated: D

The pouring procedure was started immediately after the impression was separated from the master cast using the two-stage technique. The artificial stone was mechanically spatulated (Whip Mix power mixer, Whip Mix Corp.), the plastic bowl was vibrated, and the stone mix was then vibrated into the impression. The mixing, vibrating, pouring, and setting procedures were standardized and strictly controlled with a timer.

Once recovered, the stone casts were examined for accuracy and, if acceptable, were code marked for future identification.

The distances between the marks on the casts were measured for comparison. Fig. 4 shows the distances that were measured by means of a monocular measuring microscope (Universal Toolmaker microscope, Model UWM, Leitz Wetzlar, W. Germany), which allowed readings in the 0.0001 inch range (Figs. 5 and 6). The five separate distances to be evaluated on each cast were measured by the same operator one time (Fig. 4). After all 40 casts were measured, the same distances were measured on the master cast in exactly the same manner, except that they were repeated three times.
Table I. Descriptive statistics and t tests for casts comparisons

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*Value for master cast represents mean of three determinations for each distance.
†Difference between master cast mean and each type cast mean.
‡Value for difference from master cast.
§Significant difference, p < 0.05.
¶Significant difference, p < 0.01.

All calculations were performed, and values for the measured distances were recorded.

RESULTS

Descriptive statistics were computed for the master cast and four type casts based on the measurements for each distance (Table I). The comparative t distribution method (t test) was used to determine whether there were significant differences between each type of cast and master cast. A separate analysis was performed for each of the five measurements.

The null hypothesis tested was that there would be no significant differences between any of the type casts and master cast for any of the measurements.

The detailed results are presented in Table I.

DISCUSSION

The results of this study show that all the impressions made with the tested trays presented some kind of distortion. The mean values revealed that except for the impressions made with the stock perforated tray (B), all the impressions had a tendency to be oversized. Three of
the five cast B means were smaller than the master cast means (Table I).

Four t values reflected statistical significance (Table I). Based on clinical observations, it seems that the posterior border of a maxillary impression (including the distobuccal region) is prone to distortion. Undercuts around the maxillary tuberosities and the seal of the impression in that region may provoke such distortion. This type of distortion was probably one factor responsible for the statistically significant values in the measurements of distance c-u. Failure of the nonperforated type of trays (A and C) to adequately hold the irreversible hydrocolloid in the regions mentioned above could have been another reason for distortion.

According to the t test, the overall behavior of the stock perforated tray (B) was the most satisfactory (Table I). However, three of the five range values were relatively wide, and irregular mean values resulted as compared with the master cast values. In general, the calculated mean differences of the stock perforated tray (B) were the smallest of all. The facial flange on this tray was shorter than on the other trays. For this reason, a slightly underextended impression of that region always resulted. Irreversible hydrocolloid did not flow to the facial undercut present on the master cast, and this made withdrawal of the impressions from the master cast easier. This could have been a favorable factor for the impressions made with the stock perforated tray, since the shear stress was probably reduced in that region.

Even though the custom perforated tray (D) demonstrated satisfactory results according to the t test (Table I), a wide range of measurements, irregularity of the mean values, and comparatively high mean differences indicate that the use of this type of tray does not guarantee predictable results.

The use of the Rim-lock nonperforated tray (A) demonstrated fair results, as the t test showed (Table I). Two of five distances were statistically significant. An overall analysis of the ranges shows that they had a tendency to be comparatively narrow. All five mean values of the measured distances were higher than the mean values of the master cast; and in general, the mean difference values were high.

According to the t test (Table I), the custom nonperforated tray (C) demonstrated similar but less satisfactory results than those of the Rim-lock nonperforated tray (A). In general, the ranges of measurements of the custom nonperforated tray (C) were moderately narrow. The mean values of four of the distances measured were larger than the means of the same distances on the master cast; the mean values for the fifth distance were identical. In general, the calculated mean differences were the second lowest.

The reproducibility of the palatal region (around point g, Fig. 4) is critical when making an irreversible hydrocolloid impression for the construction of a prosthesis. Any distortion that occurs in this region will affect the accuracy of fitting major connectors or denture bases. These facts demonstrated the necessity of comparing measurements of distance f-g to evaluate changes that occur in the impressions made with different types of trays. The t test showed that the means for distance f-g measured on any of the cast series were not significantly different from the mean for distance f-g on the master cast (Table I). Apparently, the impression tray that presented the least degree of distortion in the palatal region was the Rim-lock nonperforated tray (A) followed by the stock perforated tray (B) (Table I).

The two stock impression trays used in this study were used with no modification other than the placement of occlusal stops. It would be interesting to test the accuracy of these types of trays modified as recommended by several authors. A second proposal for future evaluation would be the behavior of nonperforated impression trays without adhesive for irreversible hydrocolloid.

The four t values that were statistically significant (Table I) were not thought to be clinically significant. Mean differences of 0.015 inch or greater were considered to have clinical significance.

SUMMARY AND CONCLUSIONS

An investigation was conducted to determine which of the four commonly used impression trays yields the best results when making irreversible hydrocolloid impressions. This objective was achieved by evaluating the comparative accuracy of stone casts obtained from irreversible hydrocolloid impressions made with trays of different characteristics.

The following conclusions are drawn from this study.

1. Some kind of distortion can be expected in irreversible hydrocolloid impressions with the use of any of the tested impression trays.

2. The perforated trays (B and D) reproduce more accurately the distances along the length and the width of the arch than the nonperforated trays (A and C).

3. The depth of the palatal vault (distance f-g) is reproduced most accurately by the Rim-lock nonperforated tray (A) followed closely by the stock perforated (B) and the custom nonperforated (C) trays.

4. Under the conditions of this study, all the impressions had a tendency to be oversized except the impressions made with the stock perforated tray (B). Those impressions were slightly undersized for all but two measured distances.

5. Clinically significant inaccuracies produced by any of the four tested impression trays were not found in this study.
I wish to acknowledge Dr. D. W. Foreman, Ohio State University, College of Dentistry, Columbus, Ohio, for his assistance in the statistical analysis of this research project.

REFERENCES


Cephalometrically programmed adjustable plane: A new concept in occlusal plane orientation for complete-denture patients

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It is unfortunate that no precise, scientific method exists for determining the level of the occlusal plane in edentulous patients. Hickey and Zarb,1 express this opinion, but find some assurance in the existence of certain basic principles that have proved to be clinically successful and that may be used to help achieve this objective.

Prominent among the principles is the method of orienting the occlusal plane parallel to the ala-tragus or Camper's line. This is not a new concept (Spratley2 cites a pre-1920 textbook by Fripp as having recommended its use), and its currency has not diminished. Of eight modern texts consulted,3-9 only one10 makes no mention of its usefulness.

In view of such widespread recommendation, it is surprising how much vagueness exists as to the exact nature of the ala-tragus line. Boucher10 defines it as, "The line running from the inferior border of the ala of the nose to the superior border of the tragus of the ear." However, of the seven texts that propound its use, only one provides definition, and it cites Boucher's definition.5 Two texts1-4 recommend the concept without defining or illustrating it, while three3, 8, 9 provide only pictorial representation. The latter are of immediate concern, for in each illustration, Camper's line is clearly depicted as

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