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Postmortem Identification of the Edentulous Deceased: Denture Tissue Surface Anatomy

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ABSTRACT: This model evaluates the use of dental stone casts derived from maxillary tissues and from the internal aspects of maxillary dentures for edentulous postmortem identification. Tissue topography of the total cast and of rugae tracings photographed from the casts were evaluated for identification accuracy in twenty-eight trials for each of the two designs. Eight casts were examined in each trial. The trial was designed as matching or nonmatching, and as an equivocal or unequivocal decision by the examiner. Unequivocal decisions with 100% accuracy resulted when the entire dental cast was evaluated. Seventy-nine percent accuracy with equivocation in some trials resulted when only rugae tracings from the casts were evaluated. This investigation supported use of stone casts derived from the internal anatomy of maxillary dentures for forensic science identification when cast topography in toto was considered.

KEYWORDS: odontology, human identification, edentulous deceased, castings

Forensic odontology has quantified the unique nature of tooth surface anatomy and dental restorations in human identification. Postmortem identification of the edentulous deceased has not proved the exacting science of dentate identification. The purpose of this simulation was to evaluate the use of a maxillary denture prosthesis for postmortem identification.

Method and Materials

Data were collected from 14 subjects as a series of 3 temporally related dental stone casts. The casts were derived from (1) the internal aspect (palatal tissue surface) of an existing maxillary denture, (2) the maxillary edentulous arch and soft tissues, and (3) the internal aspect of a newly fabricated maxillary denture.

Phase I: Cast Comparison

The investigative model categorized collected data as antemortem and postmortem, simulating forensic science identification of the edentulous deceased. A subject's existing denture at time of data collection represented a spare denture found in the deceased's domain. The

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newly fabricated denture represented the denture found with the deceased. The maxillary stone cast made from an alginate impression represented an edentulous stone cast obtained from the deceased's dentist. The maxillary impression was made after the patient refrained from wearing his existing denture for 48 h to allow soft tissues and rugae to rebound from denture pressures.

Stone casts from the dentures were made by pouring dental stone into the tissue surface of the denture. To assure that the stone cast could be separated from the denture after final set of the stone, anatomic undercuts in the areas of the denture flanges were blocked out with tissue paper before pouring the stone into the denture. Care was taken so as not to block out the rugae or ridge topography. A total of 42 casts were collected.

The casts were evaluated in two series of fourteen trials. Each trial in the first series consisted of eight casts whereby the new denture cast was matched against seven randomly chosen existing denture casts. Eight matching and six nonmatching trials were randomly selected.

In the second series of fourteen trials, each trial consisted of eight casts whereby the new denture cast was matched against (1) casts of both existing dentures and alginate impressions in two trials, (2) existing denture casts in seven trials, and (3) alginate impression casts in two trials. Three nonmatching trials and eleven matching trials were empirically selected.

Each trial of eight casts was evaluated for similarities and dissimilarities of the following criteria. The examiner³ evaluated pairs of casts as matching or nonmatching based on this criteria: (1) arch form, (2) overall maxilla size, (3) intertuberosity distance, (4) anterior-posterior dimension, (5) palatal vault height, (6) flanges as related to frenum attachments, (7) median palatal raphe, (8) rugae patterns with incisive papillae size and shape, and (9) ridge irregularities associated with wound healing of extraction sites. Dimensional measurements were not attempted. In addition, the examiner was asked to rate his final decision as equivocal or unequivocal.

Phase II: Rugae Comparison

In this evaluation, only palatal rugae tracings derived from the casts were used for simulated identification. All rugae, palatal raphes, and incisive papillae measuring 2 mm or greater in length were traced with pencil on the 42 casts. Each traced cast was photographed after trimming the base of the cast to correspond to a horizontal plane formed by the incisive papillae and maxillary tuberosities bilaterally. Identical camera height and film exposure were used for each cast. The rugae tracings were transferred from the photographs to drafting tracing paper. The design of the rugae trials was identical to that of the cast trials, except the 8 pieces of data for each trial were again randomly selected.

Results

Mean age of the 14 male subjects were 61 years with a range of 31 to 82 years. The mean number of years a subject had been edentulous in the maxillary arch was 22 years with a range of 2 to 45 years. The mean number of years the maxillary dentures had been in service was 19 years with a range of 2 to 45 years. Palatal relief chambers were noted in 5 existing dentures for the purpose of pressure relief over the incisive papillae and rugae area. No relief chambers were placed in the newly fabricated dentures.

Phase I: Cast Comparison

The comparison of the stone casts was accomplished with 2 series of 14 trials each. In the first series, the examiner compared the new dentures with the existing dentures in 8 matching and 6 nonmatching trials. All 14 selections were 100% accurate and unequivocal.

³A prosthodontist uninvolved in data collection or organization of the investigative model.

In the second series, the examiner compared the new denture casts to a random selection of eight other casts. Seven trials matched new dentures with the corresponding existing dentures. Two trials matched new dentures with both the existing dentures and the alginate impressions. Two trials matched the new dentures to the corresponding alginate impression casts. Three remaining trials were nonmatching. All fourteen selections were 100% accurate and unequivocal.

Phase II: Rugae Comparison

Evaluation of the rugae tracings from casts of new dentures to those of corresponding existing dentures yielded a 79% ($11/14$) accuracy. Eight matching and six nonmatching trials were conducted. The three incorrect identifications were matching trials, and the existing dentures in these trials had palatal relief chambers. Unequivocal decisions were made on twelve trials. The two equivocal decisions were made in matching trials.

The second series of fourteen trials involving the rugae tracings from casts included comparison of new dentures with the corresponding existing dentures in seven matching trials. Two trials matched cast tracings of new dentures with both the corresponding existing dentures and the alginate impressions. Two trials matched tracings from the new denture casts with alginate impression casts. Three trials were nonmatching. Evaluation yielded 79% ($11/14$) accuracy. All three nonmatching trials were correctly selected, but three matching trials were incorrectly selected.

The existing dentures in the three incorrect matching selections had palatal relief chambers. One incorrect selection involved matching a new denture tracing to an existing denture tracing. Two incorrect selections involved matching tracings of new dentures to both existing dentures and alginate impression tracings. The alginate impression tracings were correctly selected, but the examiner excluded the existing denture tracing in both trials.

Unequivocal decisions were made in twelve trials. Two of the incorrect selections were judged as unequivocal decisions and both involved existing dentures with palatal relief chambers. Two selections were judged as equivocal because of the paucity of conclusive similarities of tracings in the two trials; however, one such trial was correctly selected. The second was equivocal in relation to comparison of the new denture tracing with the alginate impression tracing. This portion of the trial was correct, but the trial was ultimately incorrect because of the exclusion of the corresponding existing denture with a palatal relief chamber.

Discussion and Conclusions

Casts collected from the 14 subjects were correctly selected in 28 unequivocal trials. A trial consisted of 1 cast examined for similarities and dissimilarities in relation to 8 other casts. The 9 criteria examined afforded specific cumulative information for identification of each cast such that an unequivocal decision was not dependent upon a matching trial. Neither were all criteria identical for a single matching trial, but adequate information existed for conclusive matching.

Arch forms and overall dimensions did not change appreciably from the time of existing denture fabrication to new denture fabrication, which varied from 2 to 45 years. Frenum attachments, palatal raphe, and rugae patterns when existent were extremely constant, but the dentures did not record the rugae patterns with total accuracy. Ridge irregularities from extraction sites and surgical scars were unique and stable over time. These irregularities afforded a characteristic ridge profile (Figs. 1 and 2).

Both series of 14 trials involving the rugae pattern tracings were correctly evaluated with 79% ($11/14$) accuracy. Paucity of adequate rugae similarities existed in the tracings because of rugae obliteration from the tissue relief incorporated in the denture. Lack of comparative

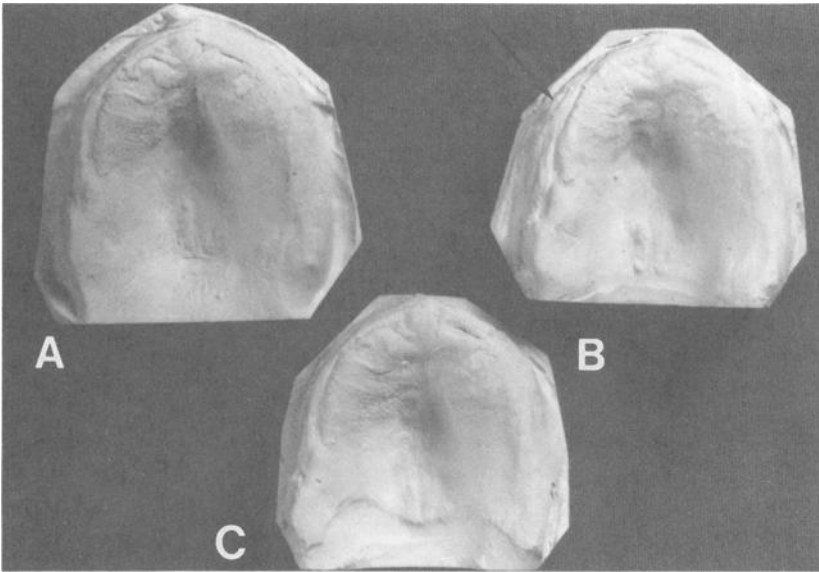


FIG. 1—Three casts collected from one subject: (a) alginate impression, (b) existing denture thirty years old, and (c) new denture. Note the consistency in the broad arch form, incisive papillae, and “groove” (arrow) on the alveolar ridge.

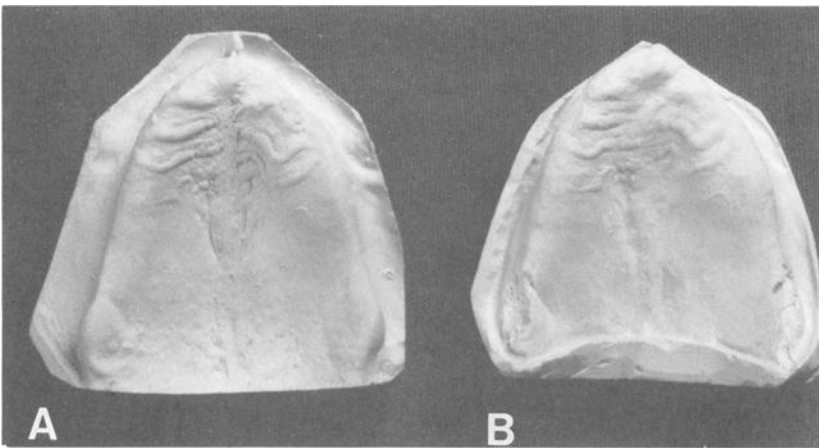


FIG. 2—Two casts collected from one subject: (a) alginate impression and (b) existing denture fifteen years old. Note the triangular arch form and rugae consistency.

evidence was such that incorrect selections were unequivocal by the evaluator. Although palatal rugae have been shown to be characteristic for identification purposes, Lysell [1] and Kogon and Ling [2] concluded that slight differences of rugae tracings existed whether it was several investigators evaluating the same cast, or a single investigator evaluating 1 cast at different times. Evaluator inconsistencies, denture impression techniques that distort the

rugae and incisive papillae, denture adjustments, palatal relief chambers, and anatomical rugae variation as a result of trauma and disease could explain equivocation in palatal rugae identification.

This investigation does support effective use of maxillary dentures as a means of edentulous forensic science identification when the entire internal aspect of the denture is reproduced by means of a dental stone cast. Examining complete topography of the cast allows accumulation of similar and dissimilar data on certain criteria to arrive at unequivocal and accurate decisions. Use of palatal rugae tracings alone derived from dentures does not achieve the accuracy desired in a forensic science investigation. This is especially true when palatal relief chambers are incorporated in the denture surface.

References

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