A PALATOGRAPHY EXPERIMENT TO SHOW THE CONTRAST BETWEEN DENTAL AND POST-ALVEOLAR STOPS IN PUNJABI

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INTRODUCTION

This experiment was carried out in the Department of Linguistic Science at the University of Reading in October 1974. It was part of an M.A. Course at this University which included a series of lectures in Experimental Phonetics given by Mr P.J.R. Roach and Dr W. Hardcastle.

This particular experiment was part of an introduction to palatography and was a preliminary attempt to use standard palatography equipment.

The palatograms used in the experiment are from photographs taken of the mouth of Mr Vasant Mahandru, an adult male whose mother tongue is Punjabi. Mr Mahandru belongs to an Indian community resident in East Africa.

PROCEDURE

The upper teeth, alveolar ridge and palate of the subject were sprayed with a mixture of charcoal and chocolate. The subject then articulated the relevant utterance six times. Without further tongue movement or swallowing, he placed his mouth over a mirror situated in front of a camera-lens so that the back part of the mirror lodged behind his back upper teeth. A flash photograph was then taken of the upper mouth in the mirror and developed immediately afterwards (the camera used was Polaroid). The developed photograph showed the area of "wipe-off" made by the articulation of the utterance.

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The whole process was repeated for each utterance and the results transferred on to graph paper to show accurately the measurement of wipe-off for each utterance (see appended photographs and palatographs).

EXPERIMENT

The subject articulated the following utterances:

(1) An unaspirated, voiceless, dental stop followed by a close, front, spread vowel [t̪i]

(2) An unaspirated, voiceless, dental stop followed by an open, central, spread vowel [t̪a]

(3) An unaspirated, voiceless, dental stop followed by a close, back, rounded vowel [t̪u]

(4) An unaspirated, voiceless, post-alveolar stop followed by a close, front, spread vowel [ti]

(5) An unaspirated, voiceless, post-alveolar stop followed by an open, central, spread vowel [ta]

(6) An unaspirated, voiceless, post-alveolar stop followed by a close, back, rounded vowel [tu]

These particular utterances were used because the dental/post-alveolar contrast is one which is found in the speaker's mother tongue (Punjabi). The vowels used are also found in Punjabi.

RESULTS

When the palatograms are charted according to the zones suggested by Firth (1948), the following general observations can be made:

1. The distinction between the dental and post-alveolar stop can be clearly seen –

DENTAL STOP: There is a wipe-off only in the dental zone in the three palatograms of [t̪]. There is some lateral contact with the sides of the tongue in the right and the left of the alveolar zone varying according to the following vowel.

POST-ALVEOLAR STOP: The wipe-off in the three palatograms for [t] is in the dental and alveolar zones although the wipe-off seems only partial. There is lateral wipe-off in both the right and left alveolar zones.

2. The influence of the vowel following the stop can clearly be seen in the three palatograms for [ʈ] but not in those for [t]. It is seen in those of the dental stop by considerable lateral contact for the front vowel, somewhat less for the central vowel, and by only slight sipe-off in the left alveolar zone for the back vowel. The contact for the three post-alveolar palatograms shows little change, i.e. the wipe-off is approximately the same for each vowel in the lateral direction (with slightly more wipe-off for the front vowel than the back in the horizontal plane).

LIMITATIONS

This experiment is obviously very limited in that it deals with the speech of only one subject and is tested for only two stops with three different vowels following in a CV sequence. It could be that different speakers, other vowels, different sequences, or voicing or aspiration of the stops could make a difference to the amount of wipe-off.

However, the experiment does show what can be achieved with standard palatography equipment and little expertise in their use. It also points to possible other areas of investigation.

FURTHER AREAS FOR INVESTIGATION

1. The partial wipe-off for the post-alveolar stops merits further investigation to see whether it is caused by tongue-curling or some other factor (possibly bad experimentation although this is doubtful as the other articulations made a clean wipe-off).

2. Linked with the previous point, Firth's experiment for Marathi indicates quite different results from these for Punjabi. Firth himself points out (in reference to Marathi) that "articulations of this type do not occur in Hindustani". However, all the stops in the post-alveolar region are usually referred to as "retroflexed" (or "cerebral") by linguists working in these Indo-Aryan languages. Perhaps some sort of distinction should be made between retroflexed and post-alveolar stops in this group of languages. For this we need to obtain palatograms of other languages, for example, Nepali.

3. It might be useful to make similar palatograms for the English alveolar stop as a means of demonstrating the different point of contact for those trying to learn Punjabi (or other IA languages) and vice-versa.

POSTSCRIPT

Standard palatography is a useful device for establishing a precise point of articulation for sounds – particularly those behind the dental position which are difficult to observe. However, recent experiments in electro-palatography (at Edinburgh and Reading Universities) offer much more exciting prospects. In these experiments a plastic palate embedded with up to 64 electrodes is fitted and inserted in the subject's mouth. These electrodes are located in regular positions around the palate and are connected to a display board palate where a light corresponds to a particular electrode and lights up when this is touched. With the aid of a cine-camera, a whole sequence of articulations can be filmed and seen in much more detail than with standard palatography procedure. This may also have useful practical applications such as teaching deaf persons to speak.

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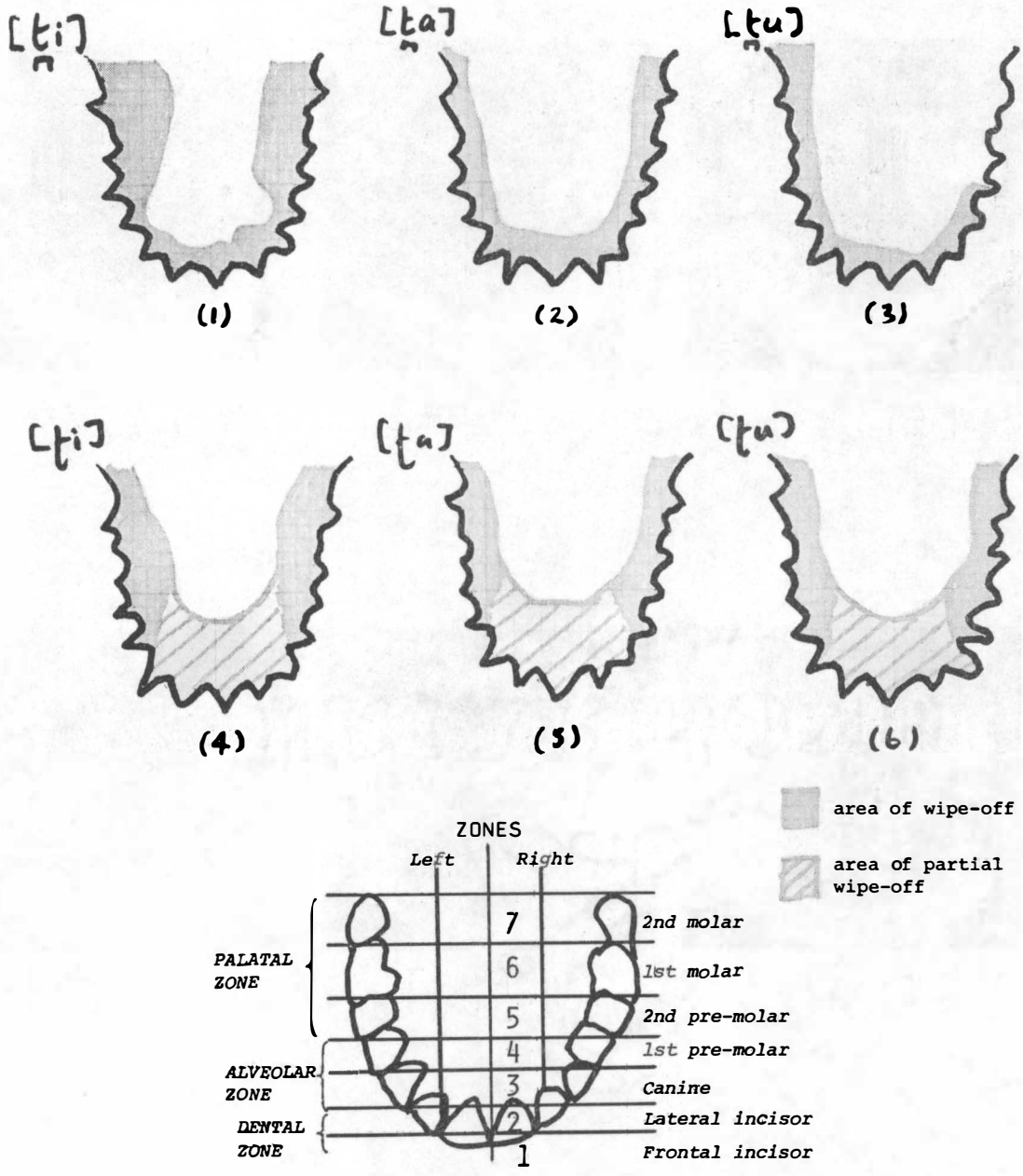
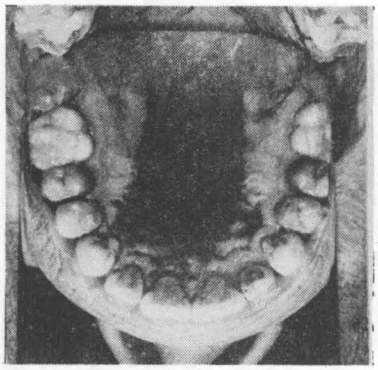
REFERENCE

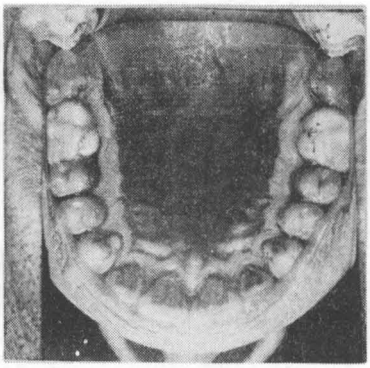
FIRTH, J.R.
1948 'Word-Palatograms and Articulation'. *BSOAS* 12:857-64.



FIRTH'S PALATOGRAM FIGURE SHOWN WITH MOUTH OF ASSISTANT USED FOR THIS EXPERIMENT



[t̪i]



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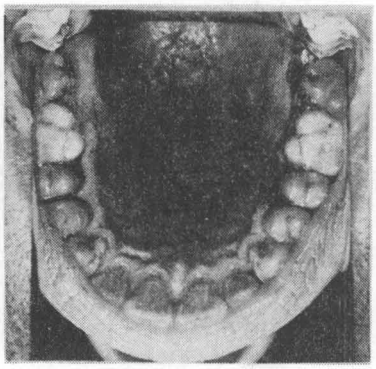

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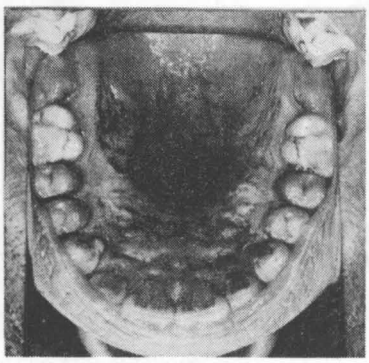
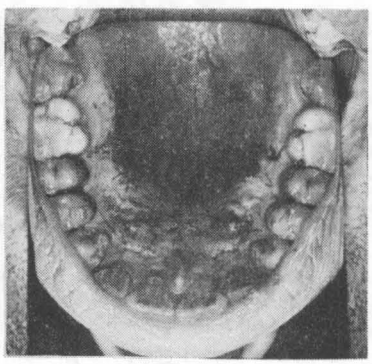
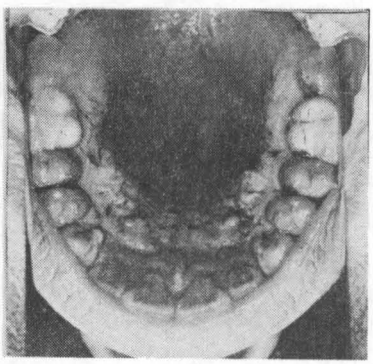


[ʈi]



[ʈa]



[ʈu]

PALATOGRAM PHOTOGRAPHS

Grainger, P.J. "A Palatography Experiment to Show the Contrast Between Dental and Post-Alveolar Stops in Punjabi". In Trail, R.E., Rathod, H.T., Chand, G, Roy, C., Shrestha, I. with Tuladhar, N.M. editors, *Papers in Southeast Asian Linguistics No. 7.* **A-53:23-28**. Pacific Linguistics, The Australian National University, 1980. DOI:*10.15144/PL-A53.23*