A NEW LOOK AT PREMOLAR TRAIT VARIATION: MAXILLARY PREMOLAR ACCESSORY RIDGES (MxPAR)

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Research on dental morphological variation has proven useful in a wide variety of genetic, forensic, and affinity assessment studies conducted during the past eighty years. Although many traits have been identified in incisor, canine, and molar teeth, relatively few premolar features have been systematically examined. Accessory ridges on the maxillary premolars are no exception.

Premolar accessory ridges are elevated crests on the occlusal crown surface which may be present both mesial and distal to the central or triangular ridge of the buccal cusp (Fig. 1). Ridges may also be present on the lingual cusp of the maxillary premolar or on the mandibular premolar, although less frequently. Accordingly, most of the little research these traits have attracted has been focused on the ridges on the buccal cusp of the upper premolars.

Although noted in several dental anatomy texts and early studies on tooth morphology (e.g., Black, 1902; Hrdlicka, 1921), few studies have systematically analyzed the occurrence of maxillary premolar accessory ridges. Instead, these ridges are often noted in the literature as "unusual features" (Taylor, 1978) though they occur in relatively high frequencies in many populations. In addition, accessory ridges have been identified in both fossil hominid (Robinson, 1956) and modern populations suggesting that the trait is an old premolar variant with a certain degree of stability.

In past studies researchers have identified this trait as lateral ridges (Hrdlicka, 1921), mid-mesial and mid-distal occlusal paracone ridges (Morris, 1965; Wasser, 1953), transverse ridges (Kraus et al., 1969), accessory occlusal ridges (Gilmore, 1968), and upper premolar accessory ridges (Scott, 1973). In following with the nomenclature used in the two most recent studies on the trait, those of Gilmore (1968) and Scott (1973), the designation "accessory ridges" will be utilized here, albeit modified by the prefix "maxillary premolar." In an attempt to standardize terminology it is suggested that the abbreviation MxPAR, for maxillary premolar accessory ridges, be adopted in future studies.

LITERATURE REVIEW

Wasser (1953) provided the first genetic analysis of the trait. Through use of twin analysis, Wasser found that dizygotic twins have ridge frequencies determined largely by chance while high concordance rates found between monozygotic twins suggest high genetic heritability. In another early study, Gilmore's (1968) population analysis of European-Americans suggested that ridges on the first premolar are related to ridges at the same loci on the second premolar.

Research by Morris (1965), using bilateral symmetry as an estimate of heritability, supported the previous indication of a significant genetic component to accessory ridge formation. Morris found that both first and second premolars were comparable in terms of overall asymmetry frequency, although distal ridges appeared to be more symmetrical in occurrence than mesial ridges. Furthermore, accessory ridges on the maxillary premolars had higher bilateral symmetry scores than ridges on mandibular premolars. This suggests that maxillary premolar accessory ridges may have less environmental influence, or more heritability, and thus may be more productive than mandibular premolars for analysis of this trait.

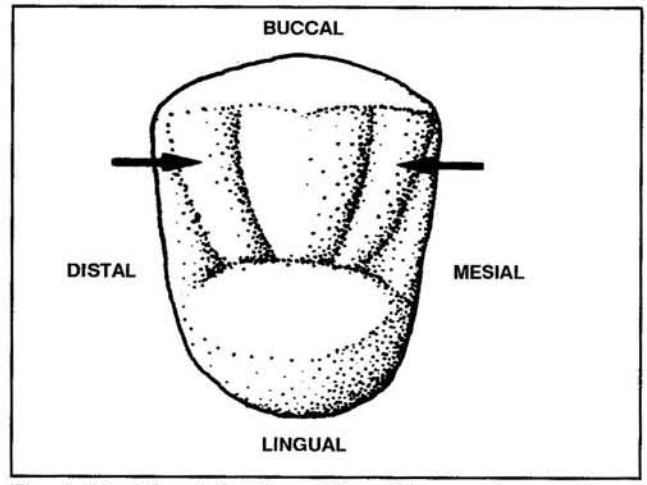

Fig. 1. Mesial and distal maxillary ridges on the maxillary right second premolar.

All prior researchers, other than Scott (1973), examined premolar accessory ridges in terms of trait

presence, but not variation in ridge size. While Scott was the first to create a scoring system based on ridge size, his system did not concentrate on the morphological variation present in the trait. His analysis did, however, provide important new data on ridge presence for historic Native American populations as well as a sample of living European-derived Americans. His results support the trait frequencies noted earlier by Gilmore for European-Americans. Scott's results illustrate higher frequencies for this trait in Native American populations, as the early results obtained by Morris (1965) suggested.

CURRENT RESEARCH

After Diane Hawkey's encouragement, I first began research on maxillary premolar accessory ridges in the fall of 1994. This initial study (Burnett, n.d.) addressed the development of an experimental three-point scoring scale. The data collected suggest that frequency of ridge occurrence, as well as the average degree of expression, increase distally in the dental arcade from P1 to P2. This combination of data may fit a model of the Butler field concept (Dahlberg, 1945) for premolar accessory ridges. The field may be considered directional in that both ridge occurrence and intensity appear to increase distally. Although Gilmore's (1968) data does not fit this model perfectly, the frequency differences in his study are not significant and cannot be considered conclusive evidence against directionality. Unfortunately, it became apparent during the analysis that a three-point scoring system, like other scales previously utilized, does not adequately reflect the morphological variation present in the trait.

As a result of more recent research by Burnett, Hawkey, and Turner (1996), we have developed a scoring system which more accurately reflects accessory ridge variation. In addition, we created a maxillary premolar accessory ridge (MxPAR) scoring plaque to improve both inter- and intra-observer error. New data support the previous indication of field concept directionality for the trait. Current research (Burnett, in progress) will provide a more in-depth analysis of the worldwide variation of MxPAR.

It is somewhat surprising to find such a paucity of studies addressing this trait in the literature since it can occur in such high frequencies in some populations. I am interested in knowing if other Dental Anthropology Association members, particularly foreign members, are aware of any additional references to this trait other than those provided here.

ACKNOWLEDGMENTS

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