Prevalence of maxillary canine–first premolar transposition in a composite African sample

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Abstract: Transposition of the maxillary canine and first premolar, or Mx.C.P1 transposition, is a rare positional anomaly that may occur more frequently in Caucasian subjects.[1] However, little information exists for nonwhite populations. The purpose of this research was to document the prevalence of Mx.C.P1 transposition in a composite sample from three African localities. Pedi (n=242) and Bushmen (n=143) dental casts and a skeletal sample of Nubians (n=205) were examined for atypical tooth order. Three cases (two Bushmen and one Nubian) of Mx.C.P1 transposition were discovered. The affected individuals (two males, one female) displayed both unilateral and bilateral transposition. Associated anomalies, found in two of three cases, included deciduous canine retention and reduced maxillary lateral incisors. Overall, 0.51% of the 590 individuals examined exhibited Mx.C.P1 transposition. This frequency is similar to other reports in the clinical dental literature and accentuates the relative rarity of this positional anomaly in most populations.

Key Words: Dental anomalies, Tooth transposition

Several studies relating to variations in tooth position appear in the recent dental literature.[1-8] One anomaly that has received much attention is maxillary canine-first premolar transposition (Mx.C.P1 transposition). Recent research by Peck, Peck, and Attia[1] suggests that Mx.C.P1 transposition is likely to be genetically controlled due to the moderate rate of bilateral occurrence, sex-associated frequency differences, increased prevalence of additional dental anomalies such as hypodontia, occurrence along family lines, and possibly varying rates of occurrence in different populations. However, this latter point is unclear because few data exist on this anomaly for nonwhite populations, and no frequencies have been determined for a sample of African ethnicity. The purpose of this study was to examine Mx.C.P1 transposition in three African samples in order to augment existing data on this tooth position anomaly in people of non-Caucasian origin and provide a preliminary estimate of their frequency of occurrence in African populations.

Materials and methods

Three African samples were analyzed for Mx.C.P1 transposition. One sample consisted of casts of Bantu-speaking Pedi people (n=242) from east-central South Africa that was obtained by Dr. Donald H. Morris in 1968 and 1969.[9] A Bushmen sample (n=143) of Kung!, Naron, Tshakwe, Mkaukau, and Gwikwe groups from Botswan consisted of duplicates made by Morris of casts originally taken by the Nuffield Foundation-Witwatersrand Kalahari Research Committee expeditions from 1958 to 1959.[9]

A skeletal sample from Nubia consisting of 205 individuals was also analyzed for transposition. This collection consists of skeletal remains excavated from archaeological sites in northern Sudan dating from the Meroitic (100 BC - AD 350), X- Group (AD 350-550) and Christian (AD 550-1350) time periods. The skeletal remains were recovered by members of the Oriental Institute and University of Chicago during excavations in 1966-68.[10-11] The Pedi, Bushmen, and Nubian collections are housed in the Department of Anthropology at Arizona State University.

All populations were examined visually for Mx.C.P1 transposition. Individuals were chosen for analysis if the tooth sequence of the permanent dentition could be determined. Accordingly, the sample includes both adults and adolescents. Unfortunately, many individuals from the archaeologically-derived Nubian population were missing teeth or exhibited excessive wear. As a result, observations that could be made on

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at least one side of the dental arch were included in an effort to bolster the final sample size. Tooth sequence in individuals missing several key teeth could frequently be reconstructed bilaterally with a high degree of certainty due to the high frequency (53-70%) of two-rooted maxillary premolars in this particular Nubian collection[10] and the extreme rarity of two-rooted maxillary canines.

Table 1
Known frequencies of Mx.C.P1 transposition

Sample	Sample N	Affected N Males	Affected N Females	Sample frequency	See reference
Composite African sample	590	2	1	0.51%	this study
Swedish school children	384	0	1	0.26%	13
Saudi Arabian dental patients	1581	0	2	0.13%	14
Scottish orthodontic patients	800	0	3	0.38%	15
Santa Cruz Isl., Calif (prehistoric)	106	4	5	8.50%	8

Results

Of the total sample (n=590), two Bushmen casts (2/143; 1.4%) and one Nubian maxilla (1/205; 0.49%) were found to have Mx.C.P1 transposition. An additional Nubian was found to have the left maxillary canine impacted over the second premolar. Since it is not clear whether this represents a true transposition, this individual was not included in the analysis. No anomalous canine placement was seen in the Pedi sample (0/242; 0%). Three affected individuals yields an overall prevalence rate of 0.51%.

Discussion

Peck et al.[1] illustrate that (1) Mx.C.P1 transposition occurs bilaterally but is more frequently unilateral, with the left side affected in the majority of unilateral cases; (2) females are more likely to exhibit transposition than males; and (3) other dental anomalies, such as tooth agenesis and peg-shaped lateral incisors, occur more often in individuals with Mx.C.P1 transposition. In the Africans reported here, one case exhibited bilateral transposition and two of three affected individuals were male. Peg-shaped or reduced lateral incisors and deciduous canine retention were each observed in one case. Hypodontia was not seen in any case. The associated anomalies found in this African sample are not surprising because their association with Mx.C.P1 transposition has been well-documented.[1] In the 82 cases of Mx.C.P1 transposition presented or reviewed by Peck et al.,[1], peg-shaped or reduced lateral incisors were found in 12 (15%) while hypodontia, excluding third molars, was found in 35 (43%). Thus, hypodontia and peg-shaped or undersized lateral incisors occur much more frequently in individuals exhibiting Mx.C.P1 transposition than in the normal population.

Mx.C.P1 transposition in Africans

Data on a larger group of Bushmen, also gathered during a Nuffield-Witwatersrand Expedition, were reported by Van Reenen in 1964.[12] Van Reenen mentioned that "three members of one family...showed a transposition of the maxillary left canine and first premolar."[12] If these three family members represent the only cases found, then 0.74% of the 406 Bushmen analyzed by Van Reenan were affected. Since only one individual presented here exhibited unilateral, left side Mx.C.P1 transposition, the bilateral case reported here probably was collected on a subsequent expedition.

Fisher's exact tests were used to check for significant differences (α=.05) between the Mx.C.P1 transposition prevalence rates of the African sample and previous reports. The prevalence rate of Mx.C.P1 transposition in the African sample is not significantly different from the rates published for Swedish schoolchildren[13] (p=.485) or dental/orthodontic patients from Saudi Arabia[14] (p=.128) and Scotland[15] (p=.506, Table 1). A sample of prehistoric Native Americans from Santa Cruz Island, California is the only published sample found with a significantly different prevalence rate[8] (8.50%, p<.001).

One of the catalysts behind this study was the recent and ongoing discussion over the causal factors related to tooth transposition. In particular, it has been suggested that Mx.C.P1 transposition is not only inherited, but that the frequency may differ in populations.[1] This study identified transposition of the maxillary canine and first premolar in a composite sample composed of three African groups (Pedi, Bushmen, and Nubians). The results suggest that Africans exhibit low population frequencies of Mx.C.P1 transposition, similar to the European and Saudi Arabian frequencies previously reported. Except for the frequency of 8.5% in a skeletal sample from the island of Santa Cruz, the frequency of this trait seems to remain well under 1% in most samples. Although previous dental morphological studies suggest biological differences between some of the samples analyzed here,[9-10] together these samples may provide a preliminary estimate of Mx.C.P1 transposition in poorly studied African populations.

Conclusions

Three cases (two males, one female) of Mx.C.P1 transposition in a sample of 590 Africans are reported. Two cases were unilateral, one on the right side and the other on the left. One individual exhibited a peg-shaped lateral incisor and an antimere significantly reduced in size. In another affected individual, the deciduous canine was retained on the

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side of the transposition. No other dental anomalies were associated with Mx.C.P1 transposition.

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