Comparisons of tooth sizes, dental arch dimensions, tooth wear, and dental crowding in Amazonian indigenous people

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Inroduction: Our objective was to assess tooth wear, arch dimensions, tooth sizes, and dental crowding in 4 remote indigenous villages on the Xingu River in Brazil. These populations have similar patterns of dietary habits and practice exclusive breast-feeding, whereas studies in human genetics show large intertribal genetic distances and low intratribal variations. **Methods:** Dental casts of 107 subjects in the permanent dentition were evaluated. Tooth wear, arch dimensions, mesiodistal tooth widths, and the irregularity index of the incisors were obtained and compared using analysis of variance or the Kruskal-Wallis test ($P < 0.05$). **Results:** Tooth wear and tooth size in the mandible were similar among villages. Three groups were discriminated. The first group included the Xicrin-Kayapó and Arara-Laranjal villages, since no significant difference was found between them. Larger tooth sizes and arch dimensions ($P < 0.001$) were found in both jaws in the Assurini village compared with the Xicrin-Kayapó and Arara-Laranjal villages; this resulted in similar dental crowding index values in these groups. The Arara-Iriri village, where a high coefficient of inbreeding had been reported, showed intermediate arch dimensions, with the mesiodistal tooth widths similar to those in the Xicrin-Kayapó and Arara-Laranjal villages. This scenario resulted in a group with the lowest irregularity index, close to 0. **Conclusions:** These Amazonian indigenous villagers, who have been genetically studied previously, showed large intergroup genetic variations and similar patterns of tooth wear. Thus, we suggest from the findings in this study that the etiology of dental crowding among the inhabitants of the Xingu River area is predominantly associated with variations in the dimensions of dental arches, related to genetic influences. (Am J Orthod Dentofacial Orthop 2016;150:839-46)

Dental malocclusions occur because of an abnormal relationship between the dental arches or changes in tooth position from intra-arch alterations. Among these intra-arch alterations, dental crowding is the most frequent, leading to orthodontic treatment for millions of people worldwide.

Scientifically, dental crowding has been called a "disease of civilization."[1,2] Studies of human[1-8] and nonhuman[9-12] primates have shown that the increased occurrence of this malocclusion should be attributed to the food manufacturing process. Arguably, the increasing availability of soft foods could cause a reduction in masticatory force, an important mechanism for fostering dental arch growth and reducing tooth mass as a result of tooth wear. Moreover, studies of ancient populations,[13-15] including indigenous Amazonian peoples,[16] have shown dental crowding even with tooth wear.

The influence of tooth size and dental arch dimensions on the emergence of crowding is yet another controversial issue. Although a consensus has been reached regarding the role of dental arch dimensions in crowding, the association between dental crowding and tooth size is inconclusive.[17-20] One group of studies reported a significant correlation,[17-23] but other studies have shown slight or insignificant associations.[17,24,25]

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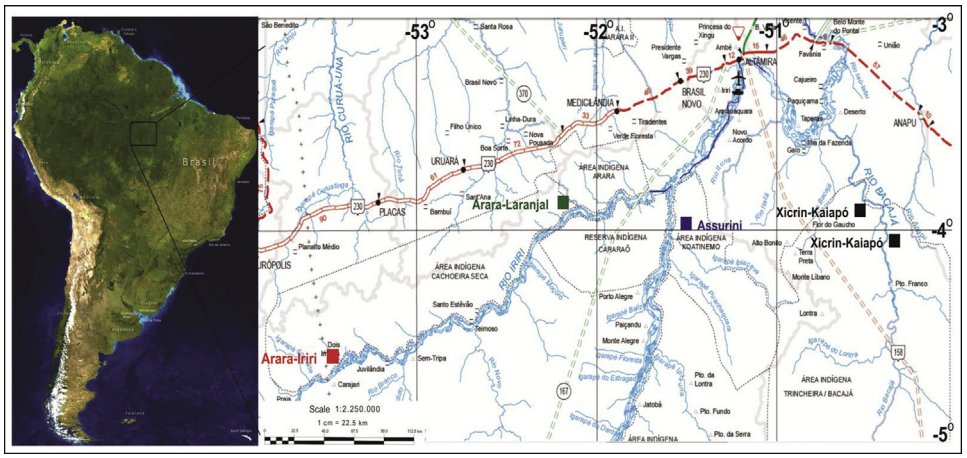

Fig 1. Location map of the Arara (Arara-Iriri and Arara-Laranjal), Assurini, and Xicrin-Kayapó (Kro-Pot and Pikayká villages) ethnic groups.

Table I. Sample size, sex, and median age by group

	Assurini (n = 22)		*Xicrin-Kaiapó (n = 30)*		*Arara-Iriri (n = 20)*		*Arara-Laranjal (n = 35)*	
Sex	*n (%)*	*Age (y)*	*n (%)*	*Age (y)*	*n (%)*	*Age (y)*	*n (%)*	*Age (y)*
Male	12 (54.5)	17.9	16 (53.3)	18.3	10 (50)	17.1	19 (54.3)	17
Female	10 (45.5)	17	14 (46.7)	21.1	10 (50)	15.8	16 (45.7)	15.2
Total	22 (100)	17.7	30 (100)	18.9	20 (100)	16.6	35 (100)	15.9

The roles of genetics and the environment in tooth morphology and dental arch dimensions, as well as the relationship between these variables and dental crowding, are still fraught with controversy. Examining 4 indigenous populations, on which previous reports[26,27] have indicated low intratribal genetic variations combined with large intertribal variations and preserved dietary habits,[28,29] provides an interesting opportunity to investigate factors related to the development of irregularities in tooth position, which might survive camouflaged in modern populations.

MATERIAL AND METHODS

The participants provided written or verbal informed consent in their native languages to be included in this study. Verbal consent was recorded for adults who could not sign. Informed consent from guardians was also obtained for the minors and children enrolled in the study. The Brazilian National Research Ethics Committee approved the informed consent and the study protocol (25000.066559/2011).

This study was done among indigenous peoples from villages on the Xingu River, a tributary of the Amazon River (Fig 1). All inhabitants of the villages were examined clinically. Thereafter, those who were in the deciduous or mixed dentition and older than 50 years were excluded, so that only subjects in the permanent dentition with all permanent teeth except the third molars were included in the study (Table I).

Measurements were made on the dental casts of 107 subjects for biometric examinations of tooth sizes and dental arch dimensions. They included 22 people from the Assurini, 30 from the Xicrin-Kayapó, 20 from the Arara-Iriri, and 35 from the Arara-Laranjal ethnic groups. The numbers of subjects by sex were similar among the groups (Table I).

The mesiodistal diameters of permanent teeth, intermolar and intercanine widths, diagonal lengths of the arches, and the irregularity index of the anterior teeth[30] were obtained by 1 examiner (H.G.A.S.) with a 150-mm digital caliper with 0.01-mm resolution (CE 03.040487ECC; TÜV Rheinland, Cologne, Germany). After 30 days, the measurements were duplicated; a difference greater than 1 mm required a third measurement, which replaced the most discrepant value.

Statistical analysis

The method error for the measurements was found by comparing 2 measurements taken at different times on 15 dental casts. Dahlberg's formula[31] was applied