

# Cusp number and groove pattern of lower molars in Icelanders

GUDJÓN AXELSSON & PENTTI KIRVESKARI

University of Iceland, Faculty of Odontology, Reykjavik, Iceland, and  
Institute of Dentistry, University of Turku, Turku, Finland

Axelsson, G. & Kirveskari, P. Cusp number and groove pattern of lower molars in Icelanders. *Acta Odontol. Scand.* 1981, 39, 361 - 366

The distribution of groove patterns and the presence of the hypoconulid on the first and second permanent lower molars of 1010 Icelanders from one urban and two rural populations was determined from dental stone casts. There was considerable modification of the ancestral Y-pattern, as expected in a Caucasoid population. Neither the sexes nor the subpopulations showed significant differences in the groove patterns. The absence of the hypoconulid on the first molar was significantly more common in women than in men, and there was also some evidence of differences between the subpopulations. On the whole, the lower molar pattern of Icelanders was within expectations.

*Key-words:* Dental morphology, racial traits

*P. Kirveskari, Institute of Dentistry, University of Turku, SF-20520 Turku 52, Finland*

Cusp number and groove pattern of human lower molars have played a prominent role in dental anthropological studies at least since the 20's. Man shares the lower molar pattern of five principal cusps and a Y-shaped groove configuration (Fig. 1) with his extant pongid relatives as well as with the ancestral dryopithecine apes. Modifications of the ancestral pattern (*Dryopithecus*-pattern, Y5-pattern) occur in an orderly manner in the Hominoidea, the second deciduous and first permanent molars being the most conservative teeth (3). The groove configuration can change from Y through + to X (Fig. 1) depending on the size and spatial relationships of the principal cusps. The modification of cusp number is normally due to the absence of the hypoconulid (distal cusp). Very rarely is

the entoconid (distolingual cusp) also absent, leaving only three principal cusps. The modifications of the ancestral pattern are much more common in man than in pongids (9).

Modern human populations show considerable variation in lower molar pattern. In spite of the sometimes questionable comparability of reported data, Caucasoid and Mongoloid populations are often distinguished on the basis of the frequencies of the different lower molar patterns (10, 13). Icelanders are unquestionably of Caucasian origin. We have earlier reported that some lower molar trait frequencies in Icelanders do not conform with current ideas of racial trait distributions (1, 2). In the present study Icelandic variations in lower molar cusp number and groove patterns were evaluated.

### MATERIAL AND METHODS

A total of 1010 Icelanders (506 boys and 504 girls) from one urban and two rural populations in Northeast Iceland (Fig. 2) were examined, and stone casts of their dentitions made in the field from alginate impressions. The subjects were mostly school-children (6–17 years); for details, see Axelsson & Kirveskari (2).

The casts were scored for the presence or absence of the hypoconulid, and for the groove configuration. The hypoconulid was scored as present if the delineating grooves were clearly visible and extended from the occlusal surface to the disto-buccal surface, and there was or had unquestionably been, a palpable enamel elevation. In the Y-pattern the basal contact between the hypoconulid and metaconid was the criterion. In the X-pattern the basal contact is between the protoconid and the entoconid. Whenever the groove configuration was determinable from the cast, but a distinction between the Y- and X-pattern could not be made by the naked eye, the pattern was scored +. Third molars were excluded because of their low number in the sample. As there was no statistically significant laterality, right side scores were used. Left side scores were used only to fill in missing right side data. The chi-square test was applied in the statistical comparisons.

### RESULTS

The distribution of the different cusp number and groove configuration combinations in the total sample is given in Table 1. All teeth from which both cusp number and groove configuration were not determinable were excluded. The number of scorable teeth increased considerably, particularly with regard

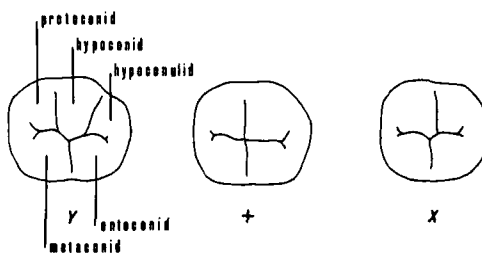


Fig. 1. Cusp nomenclature and groove patterns of lower molars.

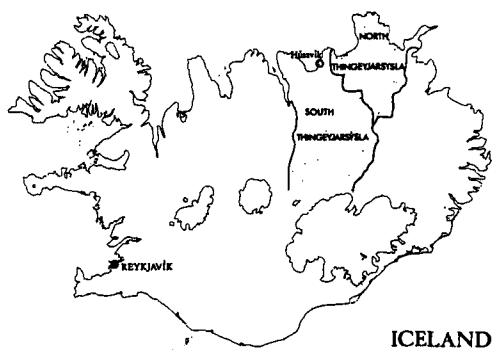


Fig. 2. Location of the populations studied.

to cusp number, when cusp number and groove configuration were analysed separately. There was statistically significant sexual dimorphism in the cusp number of M1, the girls showing more reduction than the boys, in the Húsavík sample ( $\chi^2 = 7.712$ , 1df,  $p < 0.01$ ) and in the North-Thingeyjarsýsla sample ( $\chi^2 = 3.910$ , 1df,  $p < 0.05$ ). For M2 the slight tendency in the same direction was not statistically significant (Table 2).

In South-Thingeyjarsýsla retention of 5 cusps on both M1 and M2 tended to be more common than in the other two subpopulations (Table 2). However, the tendency was statistically significant only on M1 for the girls ( $\chi^2 = 8.113$ , 2 df,  $P < 0.05$ ).

The distribution of the fissure patterns was rather uniform (Table 3). There was no statistically significant

Table 1. *Distribution of cusp-groove patterns of mandibular molars in North-Thingeyjarsýsla (N-Th), South-Thingeyjarsýsla (S-Th) and Húsavík (H), Northeast Iceland*

		N	Y4 n (%)	Y5 n (%)	+4 n (%)	+5 n (%)	X4 n (%)	X5 n (%)	
M <sub>1</sub>	N-Th	♂	43	2 ( 4.7)	35 (81.4)	1 ( 2.3)	5 (11.6)	0 ( 0.0)	0 ( 0.0)
		♀	32	3 ( 9.4)	16 (50.0)	2 ( 6.3)	10 (31.3)	0 ( 0.0)	1 ( 3.1)
		♂ + ♀	75	5 ( 6.7)	51 (68.0)	3 ( 4.0)	15 (20.0)	0 ( 0.0)	1 ( 1.3)
	S-Th	♂	71	3 ( 4.2)	46 (64.8)	1 ( 1.4)	21 (29.6)	0 ( 0.0)	0 ( 0.0)
		♀	72	6 ( 8.3)	47 (65.3)	1 ( 1.4)	14 (19.4)	0 ( 0.0)	4 ( 5.6)
		♂ + ♀	143	9 ( 6.3)	93 (65.0)	2 ( 1.4)	35 (24.5)	0 ( 0.0)	4 ( 2.8)
	H	♂	51	5 ( 9.8)	31 (60.8)	2 ( 3.9)	10 (19.6)	0 ( 0.0)	3 ( 5.9)
		♀	34	5 (14.7)	15 (44.1)	2 ( 5.9)	10 (29.4)	1 ( 2.9)	1 ( 2.9)
		♂ + ♀	85	10 (11.8)	46 (54.1)	4 ( 4.7)	20 (23.5)	1 ( 1.2)	4 ( 4.7)
Total		303	24 ( 7.9)	190 (62.7)	9 ( 3.0)	70 (23.1)	1 ( 0.3)	9 ( 3.0)	
M <sub>2</sub>	N-Th	♂	21	4 (19.0)	0 ( 0.0)	8 (38.1)	3 (14.3)	6 (28.6)	0 ( 0.0)
		♀	29	3 (10.3)	0 ( 0.0)	15 (51.7)	1 ( 3.4)	10 (34.5)	0 ( 0.0)
		♂ + ♀	50	7 (14.0)	0 ( 0.0)	23 (46.0)	4 ( 8.0)	16 (32.0)	0 ( 0.0)
	S-Th	♂	31	4 (12.9)	1 ( 3.2)	16 (51.6)	3 ( 9.7)	6 (19.4)	1 ( 3.2)
		♀	40	2 ( 5.0)	0 ( 0.0)	16 (40.0)	3 ( 7.5)	15 (37.5)	4 (10.0)
		♂ + ♀	71	6 ( 8.5)	1 ( 1.4)	32 (45.1)	6 ( 8.5)	21 (29.6)	5 ( 7.0)
	H	♂	43	2 ( 4.7)	1 ( 2.3)	21 (48.8)	3 ( 7.0)	11 (25.6)	5 (11.6)
		♀	34	2 ( 5.9)	1 ( 2.9)	14 (41.2)	3 ( 8.8)	13 (38.2)	1 ( 2.9)
		♂ + ♀	77	4 ( 5.2)	2 ( 2.6)	35 (45.5)	6 ( 7.8)	24 (31.2)	6 ( 7.8)
Total		198	17 ( 8.6)	3 ( 1.5)	90 (45.5)	16 ( 8.1)	61 (30.8)	11 ( 5.6)	

Table 2. *Cusp number of lower permanent molars in North-Thingeyjarsýsla (N-Th), South-Thingeyjarsýsla (S-Th) and Húsavík (H), Northeast Iceland*

		N	5 n (%)	4 n (%)	
M <sub>1</sub>	N-Th	♂	87	79 (90.8)	8 ( 9.2)
		♀	86	69 (80.2)	17 (19.8)
		♂ + ♀	173	148 (85.5)	25 (14.5)
	S-Th	♂	130	118 (90.8)	12 ( 9.2)
		♀	148	133 (89.9)	15 (10.1)
		♂ + ♀	278	251 (90.3)	27 ( 9.7)
	H	♂	198	176 (88.9)	22 (11.1)
		♀	170	133 (78.2)	37 (21.8)
		♂ + ♀	368	309 (84.0)	59 (16.0)
Total		819	708 (86.4)	111 (13.6)	
M <sub>2</sub>	N-Th	♂	38	5 (13.2)	33 (86.8)
		♀	49	3 ( 6.1)	46 (93.9)
		♂ + ♀	87	8 ( 9.2)	79 (90.8)
	S-Th	♂	40	5 (12.5)	35 (87.5)
		♀	70	12 (17.1)	58 (82.9)
		♂ + ♀	110	17 (15.5)	93 (84.5)
	H	♂	95	13 (13.7)	82 (86.3)
		♀	103	8 ( 7.8)	95 (92.2)
		♂ + ♀	198	21 (10.6)	177 (89.4)
Total		395	46 (11.6)	349 (88.4)	

sexual dimorphism, neither did the subpopulations show significant differences after the data were pooled.

### DISCUSSION

The paucity of data on living populations reflects the difficulty of obtaining representative material. Finding populations with known racial background and organizing a field study is difficult enough, but toughest of all seems to be to compete with modern dental health care. Fillings are placed as soon as clinically detectable caries are seen. That destroys the fissure pattern and often also the possibility to count the cusps.

The unfortunate misunderstanding, or misuse, of the groove pattern definitions (9, 12) and the notorious difficulty of determining whether or not a cusp is present, calls for great caution in comparing frequencies published by different authors. However, it seems warranted to say that Caucasoid populations show more cusp number reduction than Mongoloid populations, and that the frequencies of the Y-pattern largely overlap (cf. 10, 13).

Neither the adaptive significance of the fissure pattern nor the sequence of steps from the Y5 pattern to the modified patterns has been fully explained. There is little doubt that the Y5 pattern is the most conservative one. While the X4 pattern is usually considered to be the most advanced pattern, there is strong evidence that in fact Y4 might be the most advanced one (6, 9). Icelanders showed considerable modification of the Y-pattern, as expected; only about 70 % of the first molars and 8 % of the second molars retained the Y-pattern.

Although the cusp number counts are usually presented as total frequencies connoting lack of sexual dimorph-

ism, women tend to show more reduction, sometimes to a statistically significant degree, as in the present study. Since there is a significant association between tooth size and cusp number (5), it is to be expected that men possessing larger teeth also show more cusps. It remains unclear whether the tooth size difference alone explains the difference in cusp number.

The cusp number of lower molars of Icelanders proved to be within the expected range for a Caucasoid population. Interestingly, medieval Danes (10) showed clearly less reduction of the cusp number of the first molars than Caucasoids in general; there is a 10 % difference to the Icelanders. However, the cusp number of the second molars is almost identical in middle-aged Danes and Icelanders. In contrast, the groove pattern seems to be more modified in the Danish material. However, the comparability of observations on skulls and casts is somewhat questionable.

It is interesting that the cusp number of lower molars is not included in the «Mongoloid dental complex» used in tracing the racial origins of populations (7, 8). The deflecting wrinkle of the metaconid and the accessory cusps c6 and c7, all included in the «Mongoloid dental complex», were present in «Mongoloid» frequencies in the teeth of the Icelanders (1, 2). This calls for caution in generalizing observations on small samples. It also brings into focus our poor knowledge of trait frequency variations in living Caucasoid populations. However, the latter applies only to the western literature. Very much work has been done in the Soviet Union. Although their methods are somewhat different from our results are likely to be comparable. The data published in the Soviet Union show that lower molar cusp number is indeed a reliable indicator of racial af-