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A study on the relationship between jaw size and tooth size

Hyo-Beom Ahn[1], Dong-Seok Nahm[2]

The purpose of this study was to find whether there is a correlation between tooth size and jaw size. Dental stone models and cephalometric radiographic films of 87 untreated individuals were evaluated. Repeated measurements of the maximum mesiodistal width of the teeth were taken by means of a digital vernier caliper. Linear measurements of jaw size were assessed by means of a digitizer and Visual C++ program. All measurements were taken separately according to the subject's gender. To determine the relationship between jaw and tooth size, the Pearson correlation was used.

The results were as follows:

1. Male and female subjects showed a statistical difference in regard to tooth size and jaw size
2. In contrast to the results of the male subjects, there were no statistically significant correlations between maxillary size and maxillary teeth size in female subjects
3. In male subjects, the two maxillary sizes of PTM vert-ANS vert (FH plane) and PTM vert-A vert (palatal plane) were significantly correlated with themaxillary teeth size. Especially, the size of the upper central incisor showed significant correlation with all maxillary sizes.
4. In both male and female subjects, mandibular size B vert- Point J vert (mandibular plane) showed significant correlation with mandibular teeth size.

As gleaned from the results of this study, the relationship between jaw size and tooth size was fair or little in natural occurring good occlusion.

Key words : Tooth size, Jaw size, Pearson correlation

Department of Orthodontics, College of Dentistry, Seoul National University, Graduate student[1].
Department of Orthodontics, College of Dentistry, Seoul National University, Professor[2].

Reprint requests to : **Dong-Seok Nahm**
28-2 Yoenkun-dong, Chongno-Ku, Seoul 110-749, Korea
Department of Orthodontics, College of Dentistry, Seoul National university.
82-2-760-2678 / dsnahm@snu.ac.kr

Previous investigations seem to indicate that tooth size and jaw size are related to some extent, but the degree of this relationship remains largely uncertain. Many authors have suggested directly or by implication that dental crowding is usually associated with the presence of large teeth compared to jaw size. However, only a few studies have actually examined the relationship between tooth size and dental crowding.

The size of an anatomical structure has traditionally been evaluated by area and volume measurements. However, these measurements incorporate a mixed sense of size and shape. Therefore the volume measurements of a structure do not necessarily express its real size.

Teeth size has been considered important from an anthropological as well as orthodontic aspect, as the former observes the characteristics of population or evolutionary changes, while the latter aids in the diagnosis and treatment of malocclusion. The mesio-distal diameter of the crown of a tooth has been utilized most frequently in tooth-size studies, although this diameter is susceptible to dimensional changes due to caries and attrition. Tooth size is largely determined by heredity. Other factors which contribute to the variability of permanent tooth size are race, sex, environment etc. Environmental variations such as nutrition, disease or climate affect dentition during the prenatal period but seem to have little influence on normal dental variations.[1] But the most common and most obvious possibilities are variations in the size of the teeth themselves.

Few studies have attempted to evaluate jaw size. Lateral cephalometry has become a routine diagnostic tool for assessing the skeletodental structures and relationships. In contrast to CT or MRI scans, conventional cephalograms enjoy a marked preference due to their speed, accessibility and low cost. Linear measurements from lateral cephalometry can be applied to examine the size of the jaw. It has been thoroughly documented that measurements of the craniofacial complexes indicated moderate to high heritabilities,[2] although there often seems to be no correlation between the size of the teeth and the size of the jaws.

Table 1. Sample demographics

	No	Mean age(yr)	S.D
Female	38	22.76	1.42
Male	49	23.42	1.28
Total	87	23.13	1.37

Quite probably, it is possible to inherit tooth size from one parent and jaw size from another.[3] Undoubtedly complex hereditary factors are involved in the formation of teeth and the jaw and work to influence their relative sizes.

The purpose of this study was to identify whether there were correlations between jaw size and tooth size in subjects with naturally occurring good occlusion.

MATERIALS AND METHODS

1) Materials

The criteria for selecting subjects were as follows 1) Acceptable dentofacial relationship - i.e. naturally occurring good occlusion with class I molar relation, with zero to four millimeters of crowding, no congenitally missing teeth, no apparent skeletal discrepancies, no congenital craniofacial abnormalities, no history of orthodontic treatment. 2) Fully erupted permanent incisors, canines, premolars and molars on both sides of the maxillary and mandibular dental arches.

All teeth were assessed to be morphologically normal. Casts with gross dental abnormalities, or an apparent loss of tooth substance due to attrition, caries, or restorations which could affect the mesiodistal diameter of the crown were rejected. Eighty-seven students with class I molar relation and good teeth alignment met the above criteria. The sample was composed of 49 male and 38 female students, with the mean age for males at 23.41 years and for females at 22.76 years (Table 1).

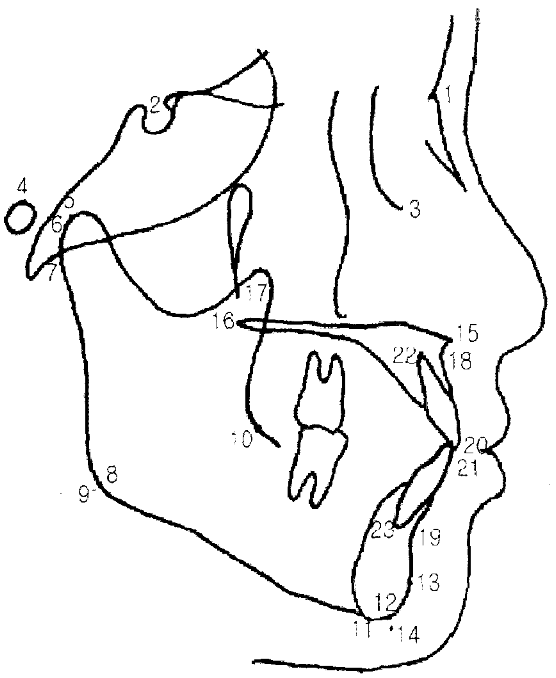

Fig. 1.
1. N 2. S 3. Or 4. Po 5. Co 6. TMJ[6]
7. Ar 8.Go 9. Go'(soft tissue) 10. Point J[7]
11. Me 12. Gn 13. Pog 14. Pog'(soft tissue) 15. ANS
16. PNS 17. PTM 18. A 19. B 20. U1E 21. L1E
22. U1A 23. L1A

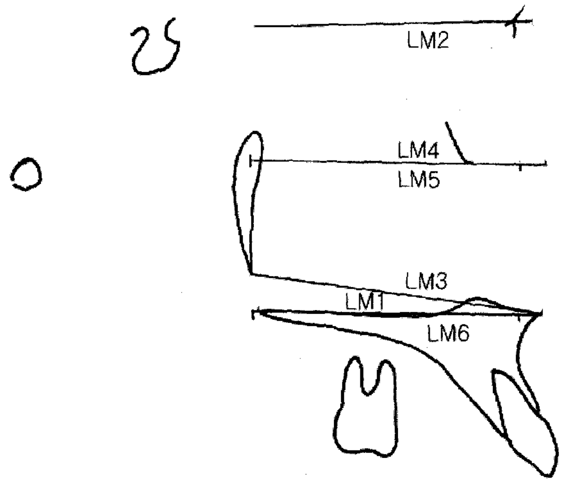

Fig. 2.
LM 1. PNS–ANS (palatal plane)[8]
LM 2. PNS–ANS (by drawing a line through nasion 7° up from S–N line)[9]
LM 3. PTM–ANS[8]
LM 4. PTM vert–ANS vert (FH plane)[10]
LM 5. PTM vert– A perp (FH plane)[11]
LM 6. PTM vert– A perp (palatal plane)[7]

2) Methods

Each subject's dental stone cast models and radiographic film were individually taken. The cast models were manufactured by conventional methods and closed mouth lateral cephalometric radiographs were obtained for each subject with a Cranex 3+ceph (Orion Co. Soredex). Measuring was done directly on unsoaped dental casts. One investigator measured the mesiodistal width of each tooth with the use of a digital vernier caliper (Mitutoyo digimatic capliper) with tips able to read to the nearest 0.01mm and precisely engineered to facilitate the greatest degree of accuracy. To minimize random and systemic errors, all procedures of measuring mesiodistal tooth diameters were performed twice by a single observer as suggested.[4,5] Each measurement was taken to the nearest 0.01mm. Each tooth was measured at its maximum mesiodistal width at the buccal or labial line angles, with measuring made parallel to the incisal surface or occlusal surface and perpendicular to the labial or buccal surface. Discrepancies between the two measurements were predetermined at 0.05mm.1 Discrepancies greater than this limit necessitated a new set of measurements and the nearest measurements were averaged. Each tooth was examined separately according to the sex of the subject.

Lateral cephalometric radiographs were traced on acetate tracing film by the author. Traced cephalometric landmarks were digitized with the Intuos Graphic Tablet (Wacom, USA). Linear and angular cephalometric measurements were chosen to represent the jaw size from various cephalometric analyses. The interpretation of data was facilitated by use of a privately designed Visual C++ program. The cephalometric landmarks, linear and angular measurements are illustrated in Fig.1–4. As well, the measuring of jaw size was performed separately according to the sex of the subject.

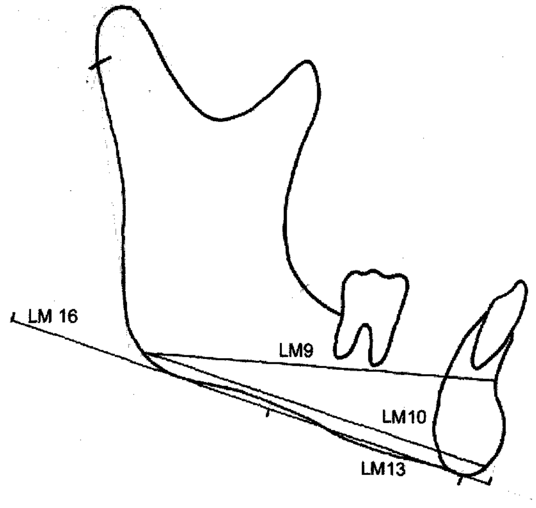

Fig. 3.
LM 9. Go-B[8]
LM 10. Go-Gn[8]
LM 13. B perp -Point J perp (Mn plane)[7]
LM 16. Ar vert- Pogs' vert (Mn plane)[10]

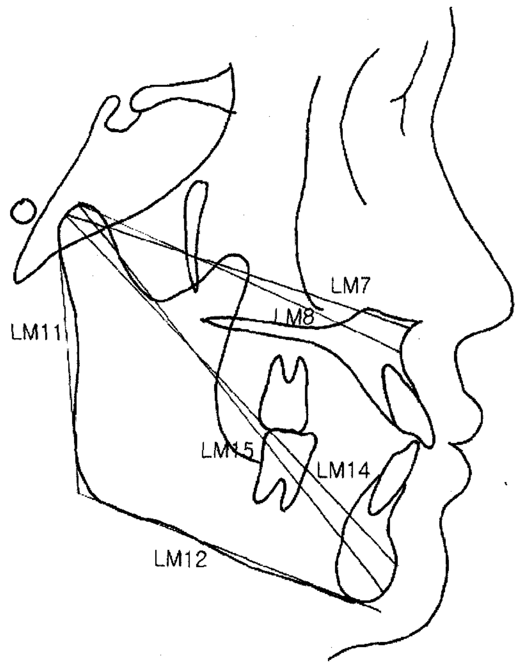

Fig. 4.
LM 7. TMJ - ANS[6] LM 8. Co-A point[12]
LM 11. Ar- Go[19] LM 12. Go'-Pog[19]
LM 14. TMJ- Pog[6] LM 15. Co-Gn[12]

3) Statistical analysis

In this study, the statistical analysis tool was the SPSS 10.0 program for Windows. An independent samples t-test was used to compare the tooth size measurements between males and females. Significance was determined at the .05 level of confidence. To test the systematic error of the measurements, repeated measurements were taken in each case. Duplicate determinations were performed at least two weeks apart with 10 measurements, giving the measurement error in terms of variance and standard deviation, and calculated according to Dalberg formula ($S_e=\sqrt{\frac{\Sigma D^2}{2n}}$ Where D is the difference between duplicate measurements and n is the number of measurements repeated.)

Error was also calculated for each of the cephalometric linear measurements. Independent t testing was also used to compare the linear measurements of jaw size between males and females. To determine the relationship between jaw size and tooth size, Pearson correlation analysis was used.

RESULTS

Error was calculated for each of the tooth measurements and cephalometric measurements respectively. The mean error for the tooth measurements was 0.08mm with ranges from 0.05 (mandibular canine) to 0.12 (maxillary first molar). The mean error for the cephalometric measurements was 0.7mm with ranges from 0.3mm (B vert- Point J vert) to 1.0mm (TMJ-ANS). None of the measurements displayed significant systematic errors. The mean and standard deviations of measurements for the male and female teeth, and t test results between the two groups, are presented in Table 2. Comparisons between male and female measurements showed that the teeth of males are larger than the teeth of females, but statistical significances were not shown in the maxillary lateral incisor, or all maxillary and mandibular premolars. When linear measurements of

Table 2. Group statistics and independent sample t-test for equality of means between male and female tooth size

	Female (n=38)		Male (n=49)		Sig
	Mean	SD	Mean	SD	
U1	8.30	0.29	8.68	0.45	***
U2	6.90	0.33	7.06	0.44	NS
U3	7.88	0.32	8.13	0.41	**
U4	7.38	0.36	7.51	0.29	NS
U5	6.89	0.34	7.01	0.36	NS
U6	10.36	0.37	10.69	0.49	**
U7	9.56	0.35	10.00	0.61	***
L1	5.32	0.23	5.48	0.34	**
L2	5.93	0.19	6.06	0.34	*
L3	6.74	0.31	7.07	0.34	***
L4	7.27	0.32	7.41	0.35	NS
L5	7.22	0.39	7.34	0.44	NS
L6	11.10	0.40	11.55	0.58	***
L7	10.41	0.50	10.80	0.67	**

* $p < .05$, ** $p < .01$, *** $p < .001$ Sig (2 tailed), NS not significant

the jaw size in males were compared with those of females, all measurements of males were significantly larger than those of females (Table 3).

To determine whether there werecorrelations between jaw size and tooth size, we calculated the Pearson correlation between each tooth size and jaw size (Table 4-7). Maxillary sizes of males PTM vert- ANS vert (FH plane) and PTM vert - A vert (palatal plane) were significantly correlated with all maxillary teeth size ($p<0.05$). Especially, the PTM vert - A vert (palatal plane) had a moderate degree of correlation with maxillary teeth size ($p<0.001$) excepting the first molar. Other maxillary sizes PTM-ANS, TMJ-ANS, Co-A point were fairly correlated with maxillary tooth size excepting the maxillary first molar. Mandibular size of males, B vert - Point J vert (mandibular plane) was significantly and fairly correlated with mandibular teeth size but the others were not nearly correlated with mandibular teeth size. In contrast to the correlations of males, maxillary sizes in females showed little correlation with maxillary teeth size. But PTM vert - A vert (palatal plane) has a slightly fair correlation with maxillary teeth size, excepting the maxillary incisor. Mandibular size in females, B vert - Point J vert (mandibular plane)was fairly and significantly correlated with mandibular teeth. But the other categories in female subjects showed little relationship with mandibular teeth size.

According to these results, it was shown that the relationship between tooth size and jaw size in males or females was either fair or little.

Table 3. Group statistics and independent samples t-test for equality of means between male and female jaw size

	Female (n=38)		Male (n=49)		Sig
	Mean	SD	Mean	SD	
LM1	54.29	2.17	56.80	3.17	***
LM2	54.06	2.33	56.49	3.55	***
LM3	55.75	2.24	58.77	2.52	***
LM4	55.54	2.22	58.61	2.49	***
LM5	50.49	2.00	52.99	2.98	***
LM6	50.47	2.03	53.48	2.96	***
LM7	93.39	2.86	98.45	4.07	***
LM8	90.03	2.88	95.10	3.99	***
LM9	79.28	4.30	82.15	4.46	**
LM10	82.85	4.91	86.33	3.71	***
LM11	55.25	5.03	61.95	4.37	***
LM12	86.06	5.60	89.56	4.26	**
LM13	46.23	3.46	48.59	2.83	**
LM14	126.53	5.97	133.63	4.29	***
LM15	128.83	6.26	136.37	4.46	***
LM16	111.20	5.61	116.45	4.97	***

** p <.01, *** p <.001 Sig (2 tailed)

Table 4. Pearson correlation between maxillar jaw size and teeth size in male subjects

	LM1	LM2	LM3	LM4	LM5	LM6	LM7	LM8
U1	0.304*	0.304*	0.415**	0.464**	0.291*	0.523***	0.411**	0.404**
U2	0.279	0.246	0.452**	0.537***	0.263	0.541***	0.409**	0.427**
U3	0.267	0.304*	0.519***	0.496***	0.553***	0.527***	0.255	0.263
U4	0.170	0.207	0.294*	0.322*	0.321*	0.535***	0.314*	0.339*
U5	0.268	0.318*	0.308*	0.401**	0.180	0.534***	0.33*	0.364*
U6	0.019	0.090	0.203	0.283*	0.083	0.397**	0.191	0.208
U7	0.191	0.245	0.307*	0.405**	0.195	0.54***	0.351*	0.382*

* p <.05, ** p <.01, *** p <.001 Sig (2 tailed)

Table 5. Pearson correlation between maxillar jaw size and teeth size in female subjects

	LM1	LM2	LM3	LM4	LM5	LM6	LM7	LM8
U1	0.115	0.097	0.223	0.193	0.234	0.314	0.172	0.191
U2	0.188	0.138	0.208	0.197	0.22	0.208	−0.02	0.015
U3	0.27	0.297	0.201	0.184	0.288	0.329*	0.148	0.263
U4	0.318	0.274	0.391*	0.409*	0.495**	0.485**	0.228	0.288
U5	0.371*	0.328*	0.431**	0.44**	0.523**	0.544***	0.336*	0.401*
U6	0.05	−0.003	0.177	0.132	0.195	0.269	0.093	0.19
U7	0.145	0.156	0.165	0.155	0.271	0.367*	0.182	0.253

* p <.05, ** p <.01, *** p <.001 Sig (2 tailed)

Table 6. Pearson correlation between mandibular jaw size and teeth size in male subjects

	LM9	LM10	LM11	LM12	LM13	LM14	LM15	LM116
L1	0.179	0.149	0.059	0.126	0.371**	0.23	0.27	0.091
L2	0.111	0.076	0.113	0.034	0.391**	0.195	0.196	0.103
L3	−0.077	−0.072	−0.034	−0.142	0.487***	0.214	0.203	0.278
L4	−0.034	−0.024	−0.057	−0.062	0.43**	0.166	0.188	0.283*
L5	−0.063	−0.032	0.007	−0.082	0.321*	0.255	0.27	0.29*
L6	−0.008	−0.044	−0.053	−0.018	0.298*	0.045	0.077	0.056
L7	0.067	0.021	0.088	0.015	0.304*	0.182	0.227	0.141

* p <.05, ** p <.01, *** p <.001 Sig (2 tailed)

Table 7. Pearson correlation between mandibular jaw size and teeth size in female subjects

	LM9	LM10	LM11	LM12	LM13	LM14	LM15	LM16
L1	0.083	0.13	0.051	0.116	0.335*	0.202	0.156	0.22
L2	0.146	0.216	0.037	0.156	0.387*	0.281	0.248	0.326*
L3	0.15	0.203	0.007	0.099	0.415*	0.296	0.29	0.403*
L4	0.178	0.232	0.114	0.205	0.425**	0.247	0.23	0.298
L5	0.268	0.307	0.284	0.272	0.374*	0.409*	0.38*	0.382*
L6	0.153	0.194	0.071	0.116	0.318	0.389*	0.352*	0.352*
L7	0.27	0.308	0.218	0.271	0.542***	0.495**	0.476**	0.466**

* p <.05, ** p <.01, *** p <.001 Sig (2 tailed)

DISCUSSION

Clinical perceptions favored the idea that heredity played a major role in both craniofacial structure and tooth-based malocclusions.[13] The unfounded conjecture of the inheritance of tooth size from one parent and jaw size from the other leading to malocclusions was still a common clinical metaphor, but it was incompatible with the contemporary understanding of polygenic inheritance. Manifestation of a malocclusion was the culmination of a hierarchy of subclinical molecular, biochemical, physiologic, and metabolic markers of risk. Any one of these could be modified by the environment, which made the clinical expression remote from gene action. This was the essence of why dentofacial structure was not suitable for analysis with Mendelian models.[13]

The samples used in this study consisted of students who attended the college of dentistry at Seoul National University. Therefore, no conclusions can be drawn about a randomly selected population and the differences of figures of subjectsbetween males and females. Obviously, there are individuals in both sexes whose tooth sizes vary markedly from these values. It cannot be denied that in many cases the teeth were of an abnormally small size. Therefore, generalizations cannot be made and each arch must be assessed individually.[14]

As mentioned above, the greatest mesiodistal measurements from an anatomic mesial contact point to the anatomic distal one of each tooth were varied, as one investigator measured it. Significant differences were not recognized when tooth size was compared with other Korean samples. The mean values for maximum mesiodistal width were similar to those reported.[15-17] Differences of measurements were shown in previous studies and this study showed the same result.

In Table III, it was shown that the maxillary and mandibular sizes of males were larger than those of female and differences were statistically significant, so in this study, male subjects had larger jaw and tooth sizes than females. Other studies on Korean subjects of similar age showed the same results.[18,19] The sizes of the maxillary lateral incisor, all maxillary and mandibular premolars were not statistically different between males and females in this study. In the case of the maxillary lateral incisor, such a finding can be explained by further evaluation of the data, which points to the significantly large standard deviations for the ratios within the maxillary incisors morphologic tooth class.

This was to be expected, since the maxillary lateral incisors vary significantly in their mesiodistal diameters in both sexes, but particularly so in females.[1] It needs to be emphasized that the presence of these findings does not supercede the fact that in individuals with large or small dental arches, the teeth in general will exhibit a corresponding increase or decrease in their mesiodistal diameters.

In Table III and IV, it was shown that the sizes of both jaws in male subjects were significantly larger than in female subjects.

Direct measurement of a three-dimensional object hada high potential for error and variability. Measurement of a two-dimensional transfer was easier and can provide the same result. Standardization of size by any variable explicitly measured, regardless of its unit, confounded the variation of that unit. The geometric size variable employed here was uncorrelated to shape coordinates, and it explained nothing but size. As mentioned above, the jaw size was applied from various cephalometric analyses.

Of course in original articles, there was no reference about 'jaw size'. Therefore, the author deliberated about jaw size and determined that linear measurements from various cephalometric analyses were indirectly defined as jaw size, despite the fact that the radiograph images were apt to be enlarged or distorted. Linear measurements representing jaw size were shown in 16 variables (Fig 2-4). LM1, 3, 8, 9, 10, 14, 15 were direct measurements between landmarks while the others were measurements between constructed landmarks on reference horizontal planes. LM7,8 were representing maxilla size but the landmarks were not included in the maxilla.

The result showed that male and female subjects were separate groups, so results were examined according to sex. Testing correlations between maxillary jaw size and tooth size in male subjects, two linear measurements, PTM vert- ANS vert (FH plane), PTM vert – A vert (palatal plane) were fairly and significantly correlated with all maxillary teeth sizes ($p<0.05$). In particular, linear measurements, and PTM vert – A vert (palatal plane) had a moderate degree of correlation with maxillary teeth size ($p<0.001$), excepting the first molar. Linear measurements of PTM–ANS, TMJ–ANS, Co–A point were fairly correlated withall maxillary teeth size except for the first molar. Linear measurements of PNS–ANS and PNS–ANS constructed (LM 2) and had little correlation with the maxillary teeth. The tips of ANS and PNS were not always visible on the cephalograms due to a superimposition of the adjacent soft tissue and bony structure.[20] PNS and ANS had good repeatability on the y coordinate but also had the highest error value, and thus showed great variability and were not a reliable landmark for horizontal measurements.[21] LM 3, 4, 6 had a fair to moderate relationship with maxillary teeth size. In contrast to the other measurements, LM6 hada moderate degree of relationship with all maxillary teeth size. LM7, LM8 had a nearly fair relationship with the maxillary teeth but ambiguously determined LM7 or LM8 as jaw size because a landmark was not included in maxilla. The size of the maxillary central incisor had a statistically significant relationship with all maxillary jaw sizes, so the size of the maxillary central incisor was a parameter to predict the size of maxilla in males with naturally occurring good occlusion. In all linear measurements, the size of the maxillary first molar showed the lowest relationship with maxillary jaw size, and it was thought that the measuring error of the maxillary first molar was greater than the other teeth.[22]

Testing relationship between mandibular teeth size and mandibular jaw size in males, LM 13 had a fair and significant relationship with the mandibular teeth. The mandible constituted two parts – corpus and ramus. In this study, the measurements of mandibular corpus were LM 13 only and the other measurements of mandible were ramus or correlated with ramus. LM9, 10, 11, 12 had the landmark, Go or constructed Go. Go had poor validity because a poor contrast did not allow the lower border of the mandible to be clearly seen, and also the small bony prominences present along the lower border of the mandible in skulls were probably not dense enough to be radio–opaque.[23] LM 11 was representing the ramal height and had little relationship with mandibular teeth size. LM 14, 15 were straight mea–surements between the articular area and symphysis area. Articular area had many superimposing structures, so the validity of landmarks in this area was poor.23 Following these results, the ramal area had little relationship with mandibular teeth size.

Testing the relationship between maxillary jaw size and maxillary teeth size in females, there were little correlations between maxillary tooth size and maxillary jaw size. LM6 had a fair degree ofrelation with maxillary teeth size, excepting the maxillary lateral incisor. In a review of literature, the maxillary lateral incisor had great variance in mesiodistal width measurements.[24-26] In contrast to the above results, the size of the maxillary second premolar had a fair and significant relationship with linear measurements of maxillary jaw size in females.

Testing the relationship between mandibular jaw size and mandibular teeth size in females, there was little degree of relationship between mandibular jaw size and mandibular tooth size. LM13 had a fair and significant relationship with mandibular teeth size.

The critical problem in this study was how to define the jaw size. Established methods of defining jaw size were restricted in their application to this study. Therefore, the author thought over the size of jaw and definedjaw size as linear measurements from cephaloradiographs. And the tooth sizewas generally defined as maximum mesiodistal width.

CONCLUSIONS AND SUMMARY

The purpose of this study was to find whether there were correlations between tooth size and jaw size. Dental stone cast models and cephalometric radio–

graphic films of 87 untreated individuals (49 males and 38 females) were evaluated. The maximum mesiodistal width of the teeth and the linear measurements of jaw size were measured repeatedly according to sex. To determine the relationships between jaw size and tooth size, Pearson correlation was used. The results of this study were as follows :

1. Male and female subjects showed a statistical difference in tooth size and jaw size
2. In contrast to the results of males, correlations between maxillary sizes and maxillary teeth sizes were either little or insignificant in female subjects.
3. In male subjects, two maxillary sizes, PTM vert-ANS vert (FH plane), PTM vert-A vert (palatal plane) were significantly correlated with themaxillary tooth size. Especially, the size of the upper central incisor showed a significant correlation with all maxillary sizes
4. In both male and female subjects, mandibular size, and B vert- Point J vert (mandibular plane) showed significant correlation with mandibular teeth size.

From the results of this study, the relationship between jaw size and tooth size was found to be fair or little in natural occurring good occlusion.

REFERENCES

1. Bishara SE. Compensatory development interactions in the size of permanent teeth in three contemporary populations. Angle Orthod 1989 : 2 : 107-12.
2. Manfredi C, Martina R, Grossi GB, Giuliani M. Heritability of 39 orthodontic cephalometric parameters on MZ,DZ twins and MN-paired singletons. Am J Orthod Dentofac Orthop 1997 : 111 : 44-51.
3. Harzer W. A hypothetical model of genetic control of tooth-crown growth in man. Arch Oral Biol 1987 : 32 : 159-62.
4. Hunter WS, Priest WR. Errors and Discrepancies in Measurement of Tooth size. J Dent Res 1960 : 39 : 405-14.
5. Lundstrom AA. Size of teeth and jaws in twins. Br Dent J 1964 : 117 : 321-6.
6. Harvold EP. The activator in Orthodontics. St Louis : CV Mosby 1974 : 307-36.
7. Di Paolo RJ, Philip C, Maganzini AL. The quadrilateral analysis : An individualized skeletal assessment. Am J Orthod 1983 : 19-32.
8. Bell WH, Proffit WR, White RP. Surgical Correction of Dentofacial Deformities, Vol I. Philadelphia : WB Saunders 1980 : 137-50.
9. Burstone CJ, James RB, Legan H, Murphy GA, Norton LA. Cephalometrics for orthognathic surgery. J Oral Surg 1978 : 36 : 269-77.
10. Wylie WL. The assessment of anteroposterior dysplasia. Angle Orthod 1947 : 17 : 97-109.
11. Coben SE. The integration of facial skeletal variants. Am J Orthod 1955 : 41 : 407-34.
12. McNamara JA Jr. A method of cephalometric evaluation. Am J Orthod 1984 : 86 : 449-69.
13. King L, Harris EF, Tolley EA. Heritability of cephalometric and occlusal variables as assessed from siblings with overt malocclusions. Am J Orthod Dentofac Orthop 1993 : 104 : 121-31.
14. Radnzic D. Dental crowding and its relationship to mesiodistal crown diameters and arch dimensions. Am J Orthod Dentofac Orthop 1988 : 94 : 50-6.
15. Jung MH, Yang WS. Causitive factors and predictability of arch length discrepancy. Korean J Orthod 1997 : 27 : 457-71.
16. Koo JH, Lee KS. Correlation between mesiodistal crown diameters of permanent teeth. Korean J Orthod 1981 : 11 : 143-50.
17. Nahm DS. Dental anthropological study on the occlusal characteristics of the Koreans. Korean J Orthod 1994 : 24 : 247-73.
18. Kang SH, Nahm DS. Roentgenocephalometric study on facial height and occlusal plane inclination in class I malocclusion group. Korean J Orthod 1995 : 25 : 111-28.
19. Oh JS, Yoon JH, Kook YA, Kim SC. A study on the skeletal and dentoalveolar dimensions in relation to vertical facial patterns. Korean J Orthod 1999 : 29 : 339-47.
20. Richardson A. An investigation into the reproducibility of some points, planes, and lines used in cephalometric analysis. Am J Orthod 1966 : 52 : 637-51.
21. Trpkova B, Major P, Prasad N, Nebbe B. Cephalometric landmarks identification and reproducibility : A Meta analysis. Am J Orthod Dentofac Orthop 1997 : 112 : 165-70.
22. Sim EJ, Hwang HS, Moon JD. A study on the error of tooth size measurements. Korean J Orthod 1999 : 29 : 491-501.
23. Tng TT, Chan TC, Hagg U, Cooke MS. Validity of cephalometric landmarks: An exprimental study on human skulls. Eur J Orthod 1994 : 16 : 110-20.
24. Potter RH, Rice JP, Dahlberg AA, Dahlberg T. Dental size traits within families: path analysis for first molar and lateral incisor. Am J Phys Antropol 1983 : 61 : 283-9.
25. Sperry TP, Worms FW, Isaacson RJ, Speidel TM. Tooth size discrepancy in mandibular prognathism. Am J Orthod 1977 : 72 : 183-90.
26. Svinhufvud E, Myllarniemi S, Norio R. Dominant inheritance of tooth malpositions and their association to hypodontial. Clin Genet 1988 : 34 : 373-81.

국문초록

치아크기와 악골크기의 상관관계에 관한 연구

안 효 범, 남 동 석

서울대학교 치과대학 교정학교실

본 연구는 치아크기와 악골크기의 상관관계를 살펴보고자 교정치료경험이 없고 교합이 양호한 87명(남자49명, 여자38명)의 치아경석고모형과 두부방사선사진을 평가하였다. 치아크기는 치아의 근원심 최대폭경을 디지털 버니어 캘리퍼스를 이용하여 반복 측정하였고 악골의 크기는 기존의 여러 두부방사선계측법에서 이용된 악골의 선계측치를 반복 측정하였다. 치아와 악골크기 모두 성별에 따라 다르게 측정하였다. 치아크기와 악골크기 사이의 상관관계를 알아보기 위해 피어슨 상관관계분석을 실시하였다.

결과는 다음과 같다

1.성별에 따라 두 군으로 나눴을 경우 악골크기와 치아크기가 두 군에서 유의성있게 다르게 나타났다.
2.남자군에서는 상악골과 상악치아 크기는 유의한 상관관계를 보이지만 여자군에서는 상악골과 상악치아 크기는 거의 상관관계를 보이지 않았다.
3.남자군에서는 상악골의 크기를 나타내는 PTM vert-ANS vert (FH plane)과 PTM vert-A vert (palatal plane)는 모든 상악치아와 유의성있는 상관관계를 보였으며 상악중절치는 상악골에 관계된 모든 계측치들과 유의성있는 상관관계를 보였다
4.남여 모두에서 하악골의 크기를 나타내는 B vert- Point J vert (mandibular plane)는 하악치아와 유의성있는 상관관계를 보였다.

위의 결과에서 자연적으로 나타나는 정상교합에서 치아와 악골크기는 상관관계가 낮거나 거의 없음을 알 수 있다.

주요 단어 : 악골크기, 치아크기, 피어슨 상관관계