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Lateral asymmetries of 93 maxillary arches.

By

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Lateral asymmetry of the dental arches has been discussed in a general way by GRÜNBERG (1913), KORKHAUS (1934), ADLER (1948), CAMPBELL (1950) and others in connection with their principle interest — clinical diagnosis.

They have assumed that symmetry of the maxilla and mandible is normal and suggested that lateral asymmetry is associated with malformation or maldevelopment of the jaws. The following investigation concerns the validity of the assumption of symmetry.

It was found by LUNDSTRÖM (1951) on the same material as used for the present study that the right side of the maxillary arch was longer by $+ 0.45 \pm 0.14$ mm than the left side. This figure was obtained by calculating the mean (for measurements parallel to the median raphe) of the right—left difference in antero-posterior position of the first permanent molars. Although the result was statistically significant, LUNDSTRÖM did not wish to draw any general conclusion from only one investigation as no good explanation of such a finding could be given. No asymmetry was found for antero-posterior positions of the first premolars.

The following investigation concerns the difference in lateral position between the right and left sides measured at right angles to the median raphe.

Material.

The material consisted of 93 tracings of plaster casts made from hydrocolloid impressions. The tracings were orthogonal projections parallel to the occlusal plane of the dental arches obtained with the help of the so-called stereograph described by R. SCHWARZ (1933).

The cusp points were marked as small holes in the tracings in order to make the measurements as accurate as possible.

The 93 tracings were obtained from a series of 139 plaster casts from 13-year-old boys. The boys were found in three elementary schools in Stockholm and with the exception of the urban nature of the community the material may be considered as originally non-selected. In 47 cases, which were eliminated, measurements were not possible for the following reasons:

Extractions	28 cases
Fillings or hypoplasia	18 cases
Insufficient eruption	1 case

Measurements.

From each tracing 4 measurements were obtained — the distances in mm from the median raphe to the mesio-lingual cusp point of each of the first molars and from the raphe to the lingual cusp point of the first premolars. A slide gauge (Mauser) was used and measurements made to the nearest 1/10 mm.

Errors of Measurements.

In order to determine accidental errors of measurement calculations were made of the standard error of single determinations. Table I shows that the two investigators (A. L. and S. H.)

Table I.

Standard error of a single determination (in mm) for measurements of lateral position relative to the median raphe of mesio-lingual and lingual cusp points of the maxillary first molars and premolars respectively.

The figures are calculated from 2 series of double measurements (by A. L. and S. H. resp.) obtained from one set of tracings of double models of 22 maxillary arches. S_1 is calculated according to the formula $\pm \sqrt{\frac{\sum d^2}{2n}}$ where 'd' is the difference between two determinations on the same arch and 'n' the number of double determinations (22).

Measurements of raphe to	S_1 of first investigator	S_1 of second investigator
First molar right side	0.30	0.30
First molar left side	0.37	0.37
First premolar right side	0.22	0.23
First premolar left side	0.20	0.19
First molar difference between right and left side ...	0.61	0.62
First premolar difference between right and left side	0.37	0.36

measured the tracings with very similar accuracy and that the accidental errors are of moderate size.

It is also of some interest to know if there are any systematic differences between the measurements of the two investigators. As can be seen from Table II very good agreement was found.

Table II.

Mean difference of measurements in mm made by two investigators.

Each measurement of the second investigator was subtracted from the corresponding measurement by the first investigator.

	First molars	First premolars
Right Side	- 0.03	- 0.05
Left Side	- 0.03	- 0.04

Results.

The purpose of the investigation was to decide whether there is any systematic lateral difference between the right and left sides of the maxillary arch. This was done by determining the mean for differences between the measurements on right and left sides at the first molars and first premolars respectively. As may be seen from Table III no such systematic differences can be demonstrated. The mean differs from zero by 0.2 mm for the first molars and is practically zero for the first premolars. There is no statistical reason to suspect that the true mean for either of the two teeth is different from zero.

Table III.

Mean (\bar{x}), standard error of mean ($\epsilon(\bar{x})$) and standard (S) for lateral differences between right and left sides measured from the raphe line to mesiolingual cusps of first molars and lingual cusps of first premolars.

Number of cases = N.

	$\bar{x} \pm \epsilon(\bar{x})$	S	N
First molars	+ 0.25 \pm 0.14	\pm 1.36	93
First premolars	+ 0.01 \pm 0.14	\pm 0.98	92

The distribution of individual deviations from full symmetry is given by the standard deviation for differences between the left and right sides. This is \pm 1.4 mm for the first molars and \pm 1.0 mm for the first premolars. These figures are definitely larger than the standard errors of the measurements (Table 1). The true dispersion of asymmetric deviations (S_c) can be calculated by eliminating the dispersion due to errors of measurements from the total

dispersion of individual deviations from symmetry according to the following formula $S_c = \sqrt{S_{tot}^2 - S_i^2}$.

The values of S_c are ± 1.2 mm for asymmetries at the first molars and ± 0.9 mm for asymmetries at the first premolars.

The asymmetric tendency can also be expressed by the correlation between the values for the right and left sides. These correlation coefficients are $+ 0.54 \pm 0.09$ for the first molars and $+ 0.70 \pm 0.08$ for the first premolars, thus demonstrating the high correlation between left and right sides, especially at the premolars.

Summary.

By measuring tracings of the maxillary arches of 93 boys, the lateral asymmetries at right angles to the median raphe were determined at the first molars and first premolars. No systematic difference between right and left sides could be demonstrated. The true standard deviations for individual differences from full symmetry (accidental errors of measurements eliminated) were calculated to ± 1.2 mm for asymmetries at the first molars and ± 0.9 mm for asymmetries at the first premolars.

Correlation coefficients for connection between right and left sides were calculated to $+ 0.54 \pm 0.09$ for first molars and $+ 0.70 \pm 0.08$ for first premolars.

Zusammenfassung.

Bei Messungen der Maxilla an 93 Knaben wurden die seitlichen Asymmetrien perpendikulär zur medialen Raphe am ersten Molaren und ersten Praemolaren bestimmt. Es konnten keine systematischen Unterschiede zwischen rechter und linker Seite nachgewiesen werden. Die tatsächlichen Standardabweichungen für individuelle Unterschiede von der vollständigen Symmetrie (gelegentliche Irrtümer bei der Messung ausgeschlossen) wurden für die Asymmetrie beim ersten Molaren mit ± 1.21 mm, für die beim ersten Praemolaren mit ± 0.911 mm festgelegt. Die Korrelationskoeffizienten für die rechte und linke Seite zusammen wurden mit $+ 0.54 \pm 0.09$ für den ersten Molaren und mit $+ 0.70 \pm 0.08$ für den ersten Praemolaren errechnet.

Résumé.

Par mensuration de tracés des arcs maxillaires de 93 garçons, les asymétries latérales perpendiculairement à la ligne médiane furent déterminées aux premières molaires et premières prémolaires. Aucune différence systématique entre les côtés droits et gauches ne fut pas prouvée. Les écarts types sûres des différences individuelles de symétrie complète (des erreurs accidentelles de mensuration éliminées) furent comptées à ± 1.2 mm pour asymétries des premières molaires et ± 0.9 mm pour asymétries des premières prémolaires.

Des coefficients de corrélation pour connection entre les côtés droits et gauches furent comptées à $+ 0.54 \pm 0.09$ pour les premières molaires et $+ 0.70 \pm 0.08$ pour les premières prémolaires.

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