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Evaluation of Craniometric Methods for Determination of Vertical Dimension of Occlusion – Part 2

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A B S T R A C T

The study examines the relationships between different craniometric distances and the nasion–gnathion (N–Gn) distance which represents the lower two thirds of the face in vertical dimension determination. The highest degree of correlation ($r = 0.9217$; $p < 0.05$) was observed between the N–Gn and zygion–zygion (Zy–Zy) distances. The N–Gn distance could be determined using the formula N–Gn = Zy–Zy / 1.15 or by means of regression analysis: N–Gn = 0.54749 + 0.82822 × Zy–Zy. Considering that the coefficient of correlation between N–Gn and Zy–Zy was higher than the one between the eye–ear (E–E) and the subnasale–gnathion (Sn–Gn) distances reported earlier ($r = 0.8676$) it was concluded that calculating the N–Gn distance from the Zy–Zy distance was more reliable. The fact that none of the calculated correlation coefficients was 1, but was lower than 1, points to the presence of individual variations of the cephalometric parameters. Although the method cannot be taken as absolutely reliable, owing to its simplicity and practical applicability it can be recommended for use in everyday clinical practice in combination with other methods for the determination of the vertical dimension of occlusion.

Key words: *craniometric, occlusion, maximal intercuspidation.*

Introduction

The vertical dimension of occlusion tends to vary throughout human's life. It is defined as the distance between two selected points, one being on the lower jaw

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and the other on the upper part of cranium, most often between the subnasal point and the gnathion, or the apex of the nose and the gnathion, in the position of maximum intercusping of the teeth[1]. As vertical dimension is determined by the interocclusal points of contact of the upper and lower dental arches, its definition no longer applies when natural teeth are missing. As a result, numerous functional and aesthetic changes take place in the entire oral-facial region and in the stomatognathic system[2]. A precise determination of intergnathic relations is therefore among the most important tasks to be considered before making a diagnosis or undertaking prosthodontic rehabilitation. It presents a specific problem and is imperative during construction of full dentures if functional and aesthetic optimum is to be achieved[3].

The position of physiological rest is often used as referent position of the mandible for the determination of the vertical dimension of occlusion, although the instability of these position throughout life has been pointed out by some authors[4–8]. Many other methods based on different criteria, likewise, have not always yielded reliable results[3,4].

Anthropometric methods for the determination of vertical dimension are based on the measurements on the soft tissues of the cranium[4,9–14], on the plaster casts of the face[15], on old photographs[16], and on radiographs (cephalometric or photocephalometric methods)[17,18]. Among the more sophisticated anthropometric methods described are image analysis, radiostereometrics, CT, laser scans, MR, holography.

The main objective of this study was to make an assessment of the cephalometric method for the determination of vertical dimension on the basis of a correlation between cephalometric parameters measured on the soft tissues of the cranium and the nasion–gnathion distance as representative variable for the lower two thirds of the face in the position of maximum intercuspation.

Subjects and Methods

A sample consisting of 103 subjects aged between 20 and 30 years participated in the study. All of the participants were without craniofacial or orthodontic anomalies, and without structural and functional dysfunctions of the stomatognathic system. They had at least 28 teeth in both jaws and were eugnathic jaw relationship (Class I Angle).

The method of measurements has already been described[14]. Measured variables were as follows: eurion–eurion (Eu–Eu), zygion–zygion (Zy–Zy), gonion–gonion (Go–Go), glabella–opisthocranion (Gl–Op), nasion–prosthion (N–Pr), pupilla–rima oris (P–RO), nasion–gnathion (N–Gn), rima oris–gnathion (RO–Gn), eye–ear (E–E; lateral border of the ocular orbit – medial wall of the external auditory canal meatus), width of the alae of the nose (WAN), and subnasale–gnathion (Sn–Gn). The Sn–Gn, RO–Gn, and N–Gn distances were measured in maximum intercuspal position.

The craniofacial indexes (ILU, ILI) were calculated. Statistical analysis comprised descriptive statistics and calculating of coefficients of correlation (r) and linear regressive analysis.

Results and Discussion

The relationships between the mean values and the coefficients of correlation (r) between all measured variables and the N–Gn distance at the 95 per cent confidence level and results of regression analysis are given in Table 1. The mean values for the Go–Go (x = 10.24) and Zy–Zy (x = 12.86) distances were closest to that for the N–Gn (x = 11.20) distance, i.e. N–Gn : Go–Go = 1:0.95 and N–Gn :

TABLE 1
COEFFICIENTS OF CORRELATION BETWEEN ANY OF THE MEASURED VARIABLES AND N–GN (X = 11.20), AND RESULTS OF REGRESSION ANALYSIS

Variable	X ± SD	X/N-Gn	r	p	a	b
Eu-Eu	15.19 ± 0.6670	1.36	0.7491	< 0.05	0.7868	–0.7563
Zy-Zy	12.86 ± 0.7795	1.15	0.9217	< 0.05	0.8282	0.5475
Go-Go	10.24 ± 0.6653	0.95	0.4909	< 0.01	0.5168	5.9012
Gl-Op	18.44 ± 0.7005	1.66	0.7074	< 0.05	0.6280	–0.3859
N-Pr	6.35 ± 0.5143	0.57	0.6412	< 0.01	0.8734	5.6459
P-RO	6.19 ± 0.5339	0.55	0.5809	< 0.01	0.7622	6.4810
RO-Gn	3.99 ± 0.6009	0.36	0.5663	< 0.01	0.6602	8.5616
E-E	6.76 ± 0.6378	0.60	0.6608	< 0.01	0.7259	6.2891
WAN	2.96 ± 0.3424	0.26	0.5201	< 0.01	1.0640	8.0434
ILU	82.43 ± 2.1702	7.36	0.0946	> 0.05	0.0305	8.6790
ILI	87.10 ± 2.1177	7.78	0.2501	< 0.05	0.0827	3.9889

Zy–Zy = 1:1.15. Correlations of all the measured variables with the N–Gn distance were positive and were statistically significant ($p < 0.05$), except for the cranial indexes ($p > 0.05$).

The highest coefficient of correlation was registered between N–Gn and Zy–Zy ($r = 0.9217$). A significantly high correlation could also be noticed between N–Gn and Eu–Eu ($r = 0.7491$). From the *a* and *b* values obtained by regression analysis (Table 1) it was possible to calculate the N–Gn distance using the formula for the regression line $y = ax+b$.

The differences which exist between races and population groups, as phenotypic expressions of a diversity of genotypic heredity appear to present insurmountable obstacles which explains positive but not fully correlations ($r < 1$) between distance N-Gn and all measured variables. The current efforts to develop standardized anthropometric methods for the determination of the vertical dimension of occlusion for individual population groups are therefore justified[14,15]. Although many methods have been described[3–15], a universal method with a fully defined scientific background is still lacking. This study is a contribution to achieving this goal and an attempt to design a reliable cephalometric method which would be simple, economical, noninvasive and easily applicable in everyday clinical practice.

Conclusion

The coefficient of correlation between N–Gn and Zy–Zy is higher than the one between Sn–Gn and E–E ($r = 0.8676$) as reported in the first part of this study.

None of the measured distances has a correlation coefficient equal to 1 ($r < 1$), not even this cephalometric method for the determination of vertical dimension of occlusion may be regarded as absolutely reliable because of individual variations within our population sample. The method, however, by all means represents a contribution towards achieving this goal.

Our results indicate that the most reliable way of determining the N–Gn dis-

tance is to calculate it, in the position of maximum intercuspation, using the formula N–Gn = Zy–Zy / 1.15 or the formula for the regression line N–Gn = 0.54749 + 0.82822 × Zy–Zy.

REFERENCES

1. ANONYMOUS: Glossary of prosthodontic terms. (CV Mosby, St. Louis, 1994). — 2. MOHL, N. D., A. J. DRINNAN, Anatomy and physiology of the edentulous mouth. In: WINKLER, S. (Ed.): Essentials of complete denture prosthodontics. (WB Saunders, Philadelphia, 1988). — 3. FAYZ, F., A. ESLAMI, J. Prosthet. Dent., 59 (1988) 321. — 4. CHOU, T. M., D. J. MOORE, L. YOUNG, A. G. GLAROS, J. Prosthet. Dent., 71 (1994) 568. — 5. ATWOOD, D. A., J. Prosthet. Dent., 6 (1956) 504. — 6. THOMPSON, J. L. Jr., G. S. KENDRICK, Anat. Rec., 150 (1964) 209. — 7. SHEPPARD, I. M., S. M. SHEPPARD, J. Prosthet. Dent., 34 (1975) 269. — 8. GARNICK, J., S. P. RAMFJORD, J. Prosthet. Dent., 12 (1962) 895. — 9. FARKAS, L. G., J. C. POSNIK, T. M. HRETZKO, Cleft. Palate Craniofac. J., 29 (1992) 303. — 10. KOURY, M. E., B. N. EPKER, J. Oral Maxilofac. Surg., 50 (1992) 806. — 11. BERESIN, V. E., F. J. SCHIESSER: The neutral zone in complete dentures: Principles and technique. (CV Mosby, St. Louis, 1973). — 12. McGEE, G. F., J. Am. Dent. Assoc., 35 (1947) 342. — 13. WILLIS, F. M., Dent. Cosmos, 77 (1935) 851. — 14. DELIĆ, Z., M. ŠIMUNOVIĆ, R. GRŽIĆ, S. VUKOVOJAC, Z. RAJIĆ, T. KUNA, T. KUNA, Coll. Antropol., 24 Suppl. (2000) 31. — 15. CASE, C. S.: A practical treatise on the technique and principles of dental orthopedia. (Case Company, Chicago, 1998). — 16. TAKASAKI, H., Applied Optics, 9 (1970) 1457. — 17. HOHL, T., L. M. WOLFORD, B. N. EPKER, R. J. FONSECA, Angle Orthod., 48 (1978) 114. — 18. PHILIPS, C., J. GREER, P. VIG, S. MATTESON, Am. J. Orthod., 86 (1984) 233. — 19. SALIB, M. M., R. L. TAYLOR, W. F. P. MALONE, J. Prosthet. Dent., 60 (1988) 520.

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PROCJENA KRANIOMETRIJSKIH METODA ZA ODREĐIVANJE VERTIKALNE DIMENZIJE OKLUZIJE: 2. DIO

SAŽETAK

Ova studija proučava odnose između različitih kraniometrijskih udaljenosti i udaljenosti nasion–gnathion (N–Gn) koja predstavlja visinu donje dvije trećine lica pri određivanju vertikalne dimenzije okluzije. Dobiven je najveći stupanj korelacije ($r = 0.9217$; $p < 0.05$) između N–Gn i udaljenosti zygion–zygion (Zy–Zy). Izračunavanje se može izvesti formulom: N–Gn = Zy–Zy / 1.15 ili formulom pravca regresije: N–Gn = 0.54749 + 0.82822 × Zy–Zy. Zbog većeg koeficijenta korelacije između N–Gn i Zy–Zy nego između udaljenosti oko–uho (E–E) i subnasale–gnathion (Sn–Gn), dobivenog u prvom dijelu ove studije ($r = 0.8676$), može se zaključiti da je izračunavanje udaljenosti N–Gn iz udaljenosti Zy–Zy pouzdanije. Niti jedna od ispitivanih korelacija nije potpuna ($r < 1$), što upućuje na individualne varijacije mjerenih kefalometrijskih parametara. Iako se ova metoda ne može smatrati apsolutno pouzdanom, zbog svoje jednostavnosti i praktične primjenjivosti može se preporučiti za svakodnevnu stomatološku praksu u kombinaciji s drugim metodama određivanja vertikalne dimenzije okluzije.