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Anthropometric measurements: A boon for recording vertical dimension of occlusion

Dr. Harekrishna Jayendra Raval
Ph. D. Scholar, Department of Prosthodontics and Crown & Bridge, Gujarat University, Ahmedabad, Gujarat, India
*Corresponding author email: harekrishna90.raval@gmail.com

Dr. Shruti P. Mehta
Vice Dean, Professor & HOD, Ph. D. Guide, Department of Prosthodontics and Crown & Bridge, College of Dental Science and Research Center, Bopal, Gujarat University, Gujarat, India
Email: mehtashrutip@gmail.com

***Abstract*---**Morphometry is a quantitative approach to find information in relation to variations and changes in the forms of organisms. Morphometry described the relationship between human body and disease. Scientists of all civilization, who existed until today, examined the human body using various anthropometric methods. Anthropometry is a branch of morphometry to study the size and shape of the components of biological forms and their variations in the populations. The field has developed rapidly over last decades. Morphometric measurements are used in the fields of medicine for diagnosis, treatment planning and treatment of the disease. Anthropometric measurements also became popular in the field of dentistry due to its advantages like simple, non invasive, easy to use, quickly, no radiation, no need of special instrumentation, etc. So, this review presents currently available various techniques for recording vertical dimension at occlusion and provide directions for future research.

***Keywords*---**anthropometric measurements, vertical dimension, vertical dimension of occlusion, cranio-facial measurements, jaw relation.

Introduction

The human body was measured for various reasons since ancient times. The term anthropometria was first appeared in the short manual anthropometria by Johann Sigismund Elsholtz in 17th century (Ulijaszek et al., 2005 – Cuff, 1998). The manual seems to be the foremost recorded material that investigated the

human body for scientific and medical purposes. It introduced a quantitative approach to get information about variations and changes in the forms of organisms that explained the relationship between the human body and disease (Ercan et al., 2012). Anthropometry is the science of measuring the weight, size and proportions of the human body by providing valuable and objective insights into how to characterize phenotypic variation and dysmorphology (Farkas, 1994)

The prosthodontist has an important role in geriatric health care with continuous increasing elder population associated with dental problems. Complete denture prosthesis includes the replacement of the lost natural dentition along with associated structures of the maxilla and mandible. Establishing the most favorable maxillo-mandibular relations, as well as correct occlusal vertical dimension is critical for the successful treatment of complete denture (de Almeida, 2016), implant-supported prosthesis (Al Baker, 2016) and full mouth rehabilitation. According to the Glossary of Prosthodontic Terms, the occlusal vertical dimension is defined as the distance between two selected anatomic or marked points (usually one on the tip of the nose and the other on the chin) when in maximal intercuspal position (GPT, 2005). Either increase or decrease in occlusal vertical dimension leads to adverse effects like aesthetics, temporomandibular joints, masticatory muscles and functional efficiency (Wang et al, 2017). In addition, improper dimension of the lower third of the face badly affects the facial expressions. Lack of consistent parameters makes the determination of occlusal vertical dimension subjective. The anthropometric measurements are routinely acquired directly from subjects by using calipers and measuring tapes. Various techniques have been proposed to determine measurements for the correct vertical dimension of occlusion. (Singh et al., 2020) When selecting the best method, criteria to be considered are accuracy and repeatability of the measurement, type and complexity of the equipment needed, adaptability of the technique and the length of time required to secure the measurement. (Singh et al., 2020)

Materials and Methods

There are various anthropometric measurement techniques/methods of recording vertical dimension at occlusion. Length of thumb - A digital caliper was used to measure the length of the thumb. Kumar et al. described that the proximal point on the radial side of the proximal crease over the first metacarpophalangeal joint and the distal point in the dactylion, the distal most part of the thumb, were marked. The ends of the caliper were placed over these two landmarks, and the distance between them gave the maximum length of thumb. (Kumar et al., 2012). Length of index finger - Length of the index finger was measured on palmar aspect (in supination) from tip of finger to the near most point on palmar digital crease with digital caliper. (Ladda et al., 2013)

Length of little finger - Length of little finger was measured from tip of finger to the farther most point on palmar digital crease. (Ladda et al., 2013). Distance from tip of thumb to tip of index finger – First subject told to place palmar aspect of the hand in pronation firmly against a flat surface with the fingers and thumb adducted. A point was marked on index finger with the help of metallic ruler and marker which represented the tip of thumb. The distance was measured with

digital vernier caliper. (Ladda et al., 2013). Craniofacial Landmarks (Majeed et al., 2018) (Figure- 1, 2, 3)

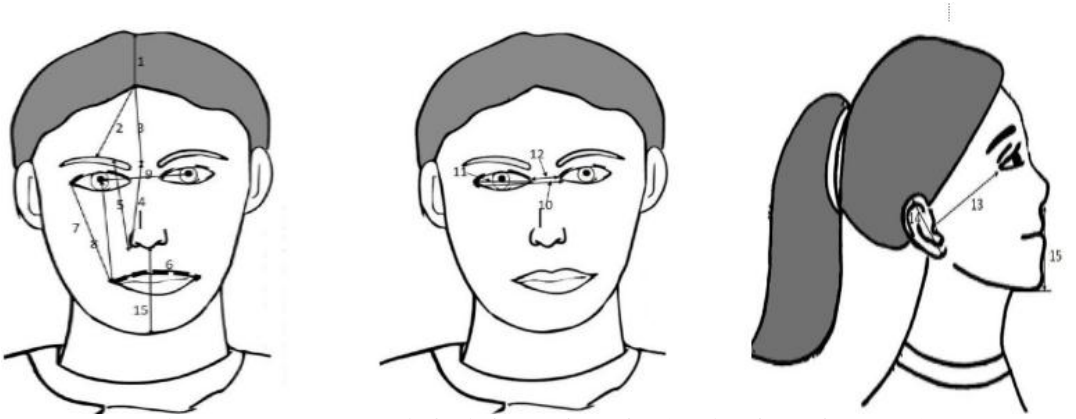

Figure 1, 2, 3. Craniofacial Landmarks (Majeed et al., 2018)

1. Top of the head (Vertex) to hairline (Trichion) distance
2. Trichion to the upper border of right eyebrow line
3. Tichion to Nasal Bridge (Nasion)
4. Nasion to the base of the right ala of the nose (alar base)
5. Right eyebrow line to the right alar base
6. Right corner of the lips (chelion) to left Chelion along the curvature
7. Outer canthus (Exocanthion) of the right eye to right labial commissure
8. Center of the pupil of the right eye to right chelion
9. Center of the pupil of the right eye to the centre of the pupil of the left eye (Pupillary distance)
10. Right eye exocanthion to the inner canthus (Endocanthion) of the left eye
11. Right eye exocanthion to Right eye Endocanthion (x2)
12. Right eye Endocanthion to the Left eye Endocanthion (x2)
13. Mesial wall of the right external auditory canal to lateral corner of the bony orbit (orbitale lateral)
14. Superior surface of right ear to inferior surface of the right ear (length of the auricle)
15. The lower border of the septum of the nose (Subnasale) to most under the surface of mandible (Gnathion).

Discussion

The traditional methods including of facial esthetics and patient comfort sounds subjectively but they are nonspecific technically. Geerts GA et al. in 2004 reported a greater variance in vertical dimension measurements with Willis gauge technique in comparison to caliper technique. Existing methods of determining the vertical dimension of occlusion do not give acceptably consistent results to the dentists. Various techniques have been proposed to determine the correct vertical dimension of occlusion using different measurements or methods. Currently, vertical dimension is measured based on physiologic references, such as swallowing threshold, physiological rest position, phonetics, and mechanical methods, such as use of pre extraction records and ridge parallelism, etc.

Being simple and non-invasive technique, craniofacial measurements and linear equations could be routinely used to determine vertical dimension of occlusion. (Majeed et al., 2018) Fenn et al. in 1953 mentioned that utilization of dimension between outer canthus of an eye-angle of mouth to determine the accurate OVD. (Fenn et al., 1953) According to Chou et al. and Abdul-Rassol, eye-ear distance is a reliable predictor for occlusal vertical dimension. (Chou et al., 1994 & Abdul-Rassol, 2007) Dhaher et al. mentioned the significant variation in the correlation between ear-eye distance and acknowledged the positive correlation only in female. (Al-Dhaher et al., 2009) The positive correlation was founded with a trichion-upper border of right eyebrow line and trichion-nasion only in males. Length of the auricle of right ear recorded the positive correlation with occlusal vertical dimension in female groups only. Correlation was observed between occlusal vertical dimension and the dimension between pupils to the chelion in both genders.

The dimension between the centre of the pupil of the right eye to chelion and right eyebrow line to right alar base showed positive correlation with occlusal vertical dimension. Majeed et al. showed the strong correlation between right eyebrow line to right alar base and occlusal vertical dimension. Ayoub reported that interpupillary distance can be used as a vertical dimension of occlusion determination factor only in males. (Ayoub, 2017) There was positive correlation between length of thumb and vertical dimension. (Sajjan, 2020) The best parameter to predict the vertical dimension of occlusion in case of males was found to be the index finger and in case of females it was little finger. (Ladda, 2013) Distance between the tip of the thumb and tip of the index finger is closest to the vertical dimension at occlusion in male patients compare to females. (Singh, 2020) The anthropometric measurement is utilized to identify the genetic disorders and also identify the individuals during forensic examinations. In future, studies can be done multi centric which include mixed races among participants to come to a positive outcome because anthropometric measurements might vary from one particular race to other or one region to region.

Conclusion

All anthropometric measurements are easy to use, predictable, easy to incorporate in practice, economic, no need of any sophisticated tools or radiographs, non invasive, quick, reproducible, etc. Traditionally various methods are used to determine vertical dimension of occlusion but these alternative anthropometric measurements also have several advantages. So, this will incorporate in routine clinical practice to measure vertical dimension of occlusion in adjunct with routine clinical techniques.

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