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ORIGINAL ARTICLE

The applicability of a non-anatomical soft and hard tissue centroid line (S&H centroid) in cephalometrics

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Abstract The applicability of a newly introduced non-anatomical soft and hard tissue cephalometric centroid line (S&H centroid) was investigated. The "S&H centroid" line established from $12'' \times 14''$ lateral cephalometric radiographs of 57 selected adults was used as a base to create a new cephalometric reference line "Centroid-Nasion". The reliability and the use of the newly created "Centroid-Nasion" as a reference line was tested against the conventional "Sella-Nasion" cephalometric reference line to evaluate the sagittal and vertical maxillary and mandibular relationship. Pearson's correlation coefficient, one way ANOVA, and Tukey multiple comparison post Hoc statistical tests were used. The digitization technique was reliable. The "Centroid-Nasion" cephalometric reference line created by utilizing the "S&H centroid" line, was found to be as useful as the conventional "Sella-Nasion" cephalometric plane in establishing and differentiating between sagittal and vertical intermaxillary relationships.

1. Introduction

Since the introduction of the centroid (Johnson, 1960), the use of the centroid in cephalometric research has been reported by many investigators (Johnson, 1978; Johnson and Hubbold, 1982; Trenouth, 1989, 1993, 2006; Fishman, 1997; Dolce et al., 2005; Sarhan, 1983, 1986; Sarhan and Al-Balkhi, 1993). The reason for the interest in utilizing the concept of the centroid in cephalometric research lies in that, mathematically it represents the least variable and the most stable point of any area or volume that is increasing in size and/or changing in shape. Thus, during growth it is considered the only non-anatomical, mathematical point that is sufficiently fixed in relation to variable points. This mathematical fact led some

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to connect the centroids of the cranium, the facial (maxillo/mandibular), and the whole bony skull to form the craniofacial centroids (CFC) line, then investigated its stability and use as a reference line (Johnson and Hubbold, 1982; Trenouth, 1989, 1993). Others utilized the basic principles of centroid orientation to establish a cephalomorphic centrographic analysis to evaluate facial balance and harmony on an individualized basis (Fishman, 1997). However, one article introduced a new centroid line – "S&H centroid" – by connecting the soft and hard tissues area centers of the outline of the skull (Al-Balkhi et al., 2008). However, the reliability of the "S&H centroid" line and it's applicability was not investigated.

The aim of this study was to investigate the reliability and applicability of the "S&H centroid" line in lateral cephalometric diagnosis.

2. Materials and methods

This prospective study was conducted after the approval of the College of Dentistry Research Center Ethical Committee of Human Studies # F1150.

The sample consisted of lateral cephalometric radiographs size $12'' \times 14''$ obtained from 57 adult (18–25 years) subjects in natural head posture. The subjects were selected upon the following criteria:

Exclusion criteria: subjects with previous orthodontic treatment, cast or extensive restorations involving cusp tips, extensive cuspal or incisal attrition, ectopic tooth eruption, and congenitally missing or extracted teeth (third molars not included), were excluded.

Inclusion criteria: adult with permanent dentition, aesthetically pleasing balanced profile with competent lips, Class I skeletal (ANB = $2^0 \pm 2$), bilateral Class I molar and canines, normal overjet (2 mm ± 2) normal overbite (2 mm ± 2), no excessive crowding or spacing and no anterior or lateral crossbites. From those lateral cephalometric images, the soft and hard tissue centroid (S&H centroid) line was presented as previously reported by Al-Balkhi et al. (2008).

To investigate the reliability and applicability of the previously presented and reported "S&H centroid" line, a perpendicular line was dropped from point Nasion (N) to the "S&H centroid" line as the perpendicular centroid point (C). By connecting Nasion (N) with, (A-Point), similarly connecting Nasion with (B-Point), the sagittal position of the maxilla (A-Point) and the mandible (B-Point) can be evaluated by measuring the angles; Centroid-Nasion-A-Point (C-N-A) and Centroid-Nasion-B-Point (C-N-B), respectively, while the difference between them, still represents their sagittal relationship to each other (Fig. 1).

Evaluating the maxillary vertical skeletal relationship was conducted by measuring the angle formed by the intersection of the Centroid-Nasion (C-N) line, with the maxillary or palatal plane (PP) to form the C-N/PP angle. Likewise, evaluating the mandibular vertical skeletal relationship was conducted by measuring the angle formed by the intersection of the C-N line with the mandibular plane (MP) to form the C-N/MP angle, while the difference between them (PP and MP) still represents their vertical relationship to each other (Fig. 2).

The sagittal and vertical maxillary and mandibular relationship were also investigated for the same sample by

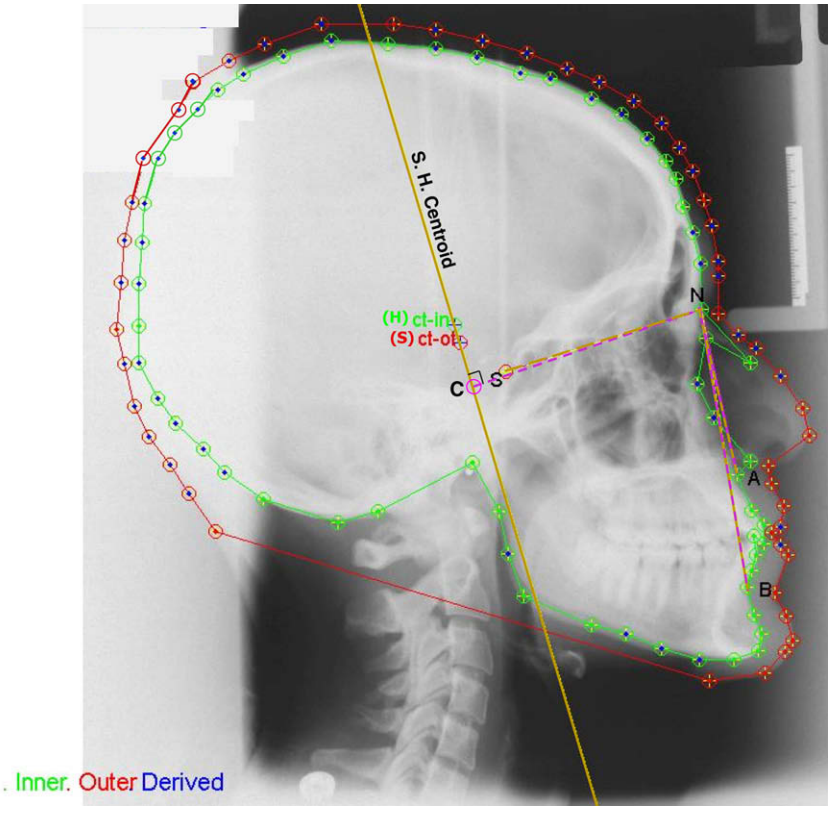

Figure 1 The centroid and conventional sagittal variables.