COMPARISON OF RIGHT TO LEFT SIDE OF FACE USING 5 PARAMETERS: A 3D-CT STUDY

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Abstract

Introduction: Although many faces may appear symmetrical and well balanced on clinical soft tissue examination, cephalometric x-ray studies have revealed varying degrees of craniofacial asymmetry as a characteristic of all faces. It has been reported that only facial asymmetries greater than 3% are clinically discernible.

Aims and Objectives: To compare right and left side of the face using three dimensional conventional tomography image (3D-CT).

Materials and Methods: The sample consisted of ten patients within the age group of 18 to 25 years. Three dimensional computed tomographic digital images were obtained from the patients and analysed using DICOM software.

Results: CT images showed that there was no statistical significance for the differences in mandibular height (***p=0.969***), ramal length (***p=0.690***), mandibular body length (***p=0.643***), frontal ramal inclination (***p=0.842***) and lateral ramal inclination (***p=0.849***).

Conclusion: In the present study we found that the right and the left sides showed equal predominance in their asymmetry.

Introduction

Each person shares with the rest of the population a great many characteristics. However there are enough differences to make each human being a unique individual. Variations in the size, shape and relationship of the dental, skeletal and soft tissue facial structures provide us with our own identity. Within the innate system of human values, symmetry and balance in nature are easily recognized and appreciated. Symmetry and balance when applied specifically to facial morphology refer to the state of facial equilibrium. They refer to the correspondence in size, shape and arrangement of the facial landmarks on the opposite sides of the median sagittal plane.

Although many faces may appear symmetrical and well balanced on clinical soft tissue examination, cephalometric x-ray studies have revealed varying degrees of craniofacial asymmetry as a characteristic of all faces[1-3].It has been reported that only facial asymmetries greater than 3% are clinically discernible[4].

Studies on laterality of the normal human skeletal face reported a dominance of the right side hemiface[5, 6]. Laterality is most common in the lower one-third of the face[7,8]. It was observed that there is less asymmetry and more dimensional stability as the cranium is approached[9].

There are many methods of assessing facial asymmetry. The oldest is direct measurement of the skull, but most popular is the analysis of cephalometric radiographs[10-12]. Some investigators have examined the face visually, while others have studied photographs[13,14]. A few have studied facial asymmetries anthropometrically[15].

Conventional radiographic images can be misleading in interpreting the cause of the deviation because complex 3-

dimensional (3D) structures are projected onto flat 2-dimensional (2D) surfaces, creating possible distortion of the images and subsequent magnification errors[16,17]. The development of computed tomography (CT), however, has greatly reduced the possibility of these errors and improved our ability to understand the 3D nature of facial structures[18]. In addition, recently introduced 3D CT software enables 3D reconstruction and accurate measurement of the maxillofacial complex[19]. 3D images can provide accurate and detailed information for the diagnosis and treatment planning of facial asymmetry by means of quantitative measurement and comparison between the right and left sides of the structures[20]. This study was conducted to compare right and left sides of the face for symmetry using three dimensional conventional tomography image (3D-CT).

Methodology

The sample consisted of 10 patients selected from the outpatients to the Department of Orthodontics and Dentofacial Orthopedics, Rajarajeswari Dental College and Hospital, Bangalore. The patients were selected based on the following inclusion and exclusion criteria.

Inclusion criteria:

1. Patients within the age group of 18 to 25 years.
2. Patients with the full complement of permanent teeth (excluding third molars).

Exclusion criteria:

1.Patients who have undergone Orthodontic/ Orthopedic/ Orthognathic surgical treatment.
2. Patients with history of trauma.
3.Patients with obvious/ gross facial asymmetry.

A written consent was obtained from all the patients and ethical clearance was obtained from the ethical clearance committee before taking 3-D CT.

Three dimensional computed tomographic digital images were also obtained from the patients using Xvision GX, Toshiba (Figure1).

CT scans of the 10 subjects were obtained using a spiral CT scanner with a mode of 2.5 mm thickness, slice pitch 3, and a scanning time of 0.8 seconds.

The acquired 3D CT digital image data were transferred on to a computer using DICOM software (Digital Imaging and Communication in Medicine).

The following parameters were used to assess the symmetry of the face.

1. Mandibular height - Canine to mandibular plane (Ag-Me-Ag) distance from the canine cuspal tip perpendicular to the mandibular plane (in mm) (Figure 2)
2.Ramus length: Condylion superior – Gonion inferior distance between the highest point of the condyle and the lowest point of the gonion area (in mm) (Figure 3)
3.Mandibular body length: Menton – Gonion posteriordistance between mentonand the most posteriorpoint of the gonion area (in mm) (Figure 4)
4.Frontal ramal inclination: Condylion lateral – Gonion lateral to mid-sagittal reference plane (Op-Cg-ANS) angle formed by the FH plane and the posterior border of the ramus (in degrees) (Figure 5)
5.Lateral ramal inclination: Condylion posterior – Gonion posterior to FH (Po-Or-Po)angle formed by the FH plane and the posterior border of the ramus (in degrees) (Figure 6).

The means and standard deviations of each parameter were calculated and summarized. Statistical analysis was done using the ANOVA, followed by the Newman-Keuls post hoc test to determine the difference

Figure 1: X vision GX machine

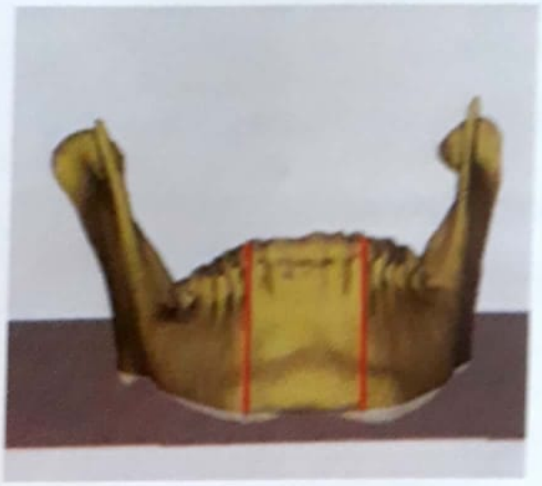

Figure 2: Mandibular height

Figure 3: Ramus length

Figure 4: Mandibular body length

Figure 5: Frontal ramal inclination

Figure 6: Lateral ramal inclination

Parameters	Right	Left	Difference	P value
Mandibular height (mm)	35.12±3.69	35.14±2.74	0.88±0.74	0.969
Ramal Length(mm)	54.81±6.30	55.33±5.03	2.79±2.65	0.690
Mandibular body length(mm)	72.13±6.98	72.57±5.67	1.86±2.15	0.643
Frontal Ramal Inclination (degrees)	84.20±4.57	84.00±4.42	2.20±2.04	0.842
Lateral Ramal Inclination (degrees)	91.10±5.26	91.30±4.67	2.40±2.01	0.849

Table 1: Comparison of parameters between Right and left sides in 3D CT measurements between the three groups. The 'p' value < than 0.05 was considered as statistically significant.

Results

CT images showed

1. Mandibular height was found to be **35.12 mm** (±3.69 mm) on the right side and **35.14 mm** (± 2.74mm) on the left side. The average difference between the right and left sides was found to be **0.88 mm** (± 0.74mm). The difference between the right and left side was found to be statistically not significant (***p> 0.05***).

2. Ramal length was found to be **54.81 mm** (±6.30 mm) on the right side and **55.33 mm** (± 5.03mm) on the left side. The average difference between the right and left sides was found to be **2.79 mm** (± 2.65mm). The difference between the right and left side was found to be statistically not significant (***p> 0.05***).

3. Mandibular body length was found to be **72.13 mm** (±6.98 mm) on the right side and **72.57 mm** (± 5.67mm) on the left side. The average difference between the right and left side was found to be **1.86 mm** (± 2.15 mm).The difference between the right and left side was found to be statistically not significant (***p> 0.05***).

4. Frontal ramal inclination was found to be **84.20^0** (±4.57^0) on the right side and **84.00^0** (± 4.42^0) on the left side. The average difference between the right and left sides was found to be **2.20^0** (± 2.04^0). The difference between the right and left side was found to be statistically not significant (***p> 0.05***).

5. Lateral ramal inclination was found to be **91.10^0** (±5.26^0) on the right side and **91.30^0** (± 4.67^0) on the left side. The average difference between the right and left side was found to be **2.40^0** (± 2.01^0). The difference between the right and left side was found to be statistically not significant (***p> 0.05***).

Discussion

Perfect bilateral body symmetry is largely a theoretical concept that seldom exists in living organisms. Right-Left side differences

occur everywhere in nature where two congruent but mirror image types are present. The frequency, site and degree of facial laterality give important clues in our understanding of the etiology of facial asymmetry and improve our diagnosis and treatment plans for patients with dentofacial deformities.

Recently introduced 3D-CT software enables 3D reconstruction and accurate measurement of the maxillofacial complex[20]. The rotating function and the computer-aided 3D measure function enable precise analysis, clear visualization and quantification of the right and left difference of the structure. The present study was conducted to compare right side to left side of the face for symmetry using three dimensional conventional tomography image (3D-CT).

The result of the present study can be discussed under 5 parameters of which 2 are angular and 3 are linear measurements.

Linear measurements are mandibular height with average difference between right and left sides of **0.88 mm** (± 0.74mm), ramal length with average difference between right and left side of **2.79 mm** (± 2.65mm) and mandibular body length with average difference between right and left side of **1.86 mm** (± 2.15 mm).

Angular measurements are frontal ramal inclination with average difference between the right and left sides of **2.20^0** (± 2.04^0), and lateral ramal inclination with average difference between the right and left sides of **2.40^0** (± 2.01^0).

All linear measurements showed left side of the face being more predominant than right side. Angular measurements showed lateral ramal inclination predominance on left side while frontal ramal inclination showed predominance on right side but it was found to be statistically not significant. These findings are in agreement with the study[12], who demonstrated an overall facial asymmetry with the left side being larger than the right.

Conclusion

1) 3D images are useful to better understand facial asymmetrical structures.
2) In the present study we found that right and the left sides showed equal predominance in their asymmetry.
3) Except for frontal ramal inclination, all other parameters showed left side measurement being greater than right side which was not statistically significant.

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