# Computer Aided Photogrammetry for Evaluation of Facial and Dental Symmetry

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## Original paper

**SUMMARY**

Maxillary anterior teeth have dominant role in the outlook of the dento-labial complex by their position, shape and size. If they are in harmony with other orofacial components they significantly contribute to the aesthetics of the face. Symmetry is one of essential component in the perception of dento-facial aesthetics. The aim of this study was to analyze coincidence between the dental and facial midlines and parallelism between the incisal plane and bipupilar line.

**Material and methods:** In the present study participated 81 subjects (44 female and 37 male) average age of 23 years, with intact dentition and in the Angle class I. They were chosen based on their facial and dental symmetry. Digital photo “the full face with smile” were taken for every examinee and analyzed by computer software (Corel DRAW Graphic Suite 12) Results: Digital photogrammetric measurement of the face showed that mid of the face and mid of the teeth corresponds in 81% of the cases, but both interpupilar and incisal lines were parallel in 90% of the examinees. All midline deviations were within 1.7 mm. Statistical procedure of hi-square (χ²) test showed that none of the indicators of the face symmetry significantly differ per gender (p> .30).^Conclusion: Computer aided photogrammetry is useful, precise and reliable method for evaluation of dental and facial aesthetics. Midline deviation of teeth, nose and chin within 1,7 mm is aesthetically acceptable.

**Key Words:** dental midline, facial symmetry, esthetic dentistry.

## 1. INTRODUCTION

The arrangement, shape and size of maxillary anterior teeth play an important role in facial aesthetics. If they are in harmony with the other orofacial components they significantly contribute to the aesthetics of the face. Symmetry is one of the essential parameters in the aesthetic evaluation. (1, 2, 3) At the time of determination of the symmetry of the face and teeth are used imagined horizontal and vertical lines, which could be observed in the frontal and sagittal direction. In symmetry evaluation is essential that the line which goes by the mid of the face is identical to the line of the contact of the upper central incisors (interincisal line). Imagined horizontal lines significant in the aesthetic evaluation are line of the hair, line of the eye brow, interpupilar line, interalar line and intercommisular line. Parallelism of those lines creates horizontal symmetry and unified the face composition. Interpupilar line is used as reference line in the evaluation of incisal and occlusal plane. From the aesthetic aspect ideal is considered when inter pupilar line and line drawn on incisal edges of incisor (incisal line) are parallel and both vertical to the line which goes on the mid of the face (4). Several studies have been done to test how far the maxillary midline can laterally deviate from the facial midline before achieving an unacceptable esthetic result. Beyer and Lindauer, Johnston et al, Seki and Suzuki, Cardash et al found that a dental to facial midline discrepancy greater than two millimeters is esthetically unacceptable. In a similar investigation, Kokich et al found that discrepancies of up to four mm could go undetected (5, 6).
Digital frontal photos of the face with the smile of all subjects were made. All examinees were photographed under the same conditions. Before making photos the head of the examinee was positioned in which Frankfort Horizontal Plane and interpupillary line are parallel with the surface of the floor, and examinees were asked to smile naturally and direct their sight in the distance. Digital photo camera (Panasonic Lumix DMC-FZ20PP) was fixed on the tripod and one meter distant from the face of the examinee. Imagined line from the mid of the lenses to the eyes was parallel with the surface of the floor. Photos must be standardized, position of the head and distance from the camera precisely determined in order to decrease the possibility of the mistake (13, 14, 15, 16).

2. MATERIAL AND METHODS

In this research participated 81 subjects (44 female and 37 male) of the average age of 23 years. Criterion for form of the samples was absence of the visible asymmetry of the face and orthodontic anomalies. Upper frontal teeth had to be intact (without filling, crowns, veneers and noticeable abrasion of the incisal edge), but there were permissible minimal deviations in the form of rotation or inclination of some teeth. Examinees were informed about research and their role in it, after which they gave their written consent.

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Analysis of the correspondence of the line which goes by mid of the face with the line which goes between the central incisors shows that those two lines correspond in 81% of the cases. (Graph 1) Such percentage is over the results in the Miller, Al Wazan and Soares studies what could be explained by high criterion at the time of defining of the samples and selection of the examinees.

3. RESULTS AND DISCUSSION

Results are shown on graphs. Analysis of the correspondence of the line which goes by mid of the face with the line which goes between the central incisors shows that those two lines correspond in 81% of the cases. (Graph 1) Such percentage is over the results in the Miller, Al Wazan and Soares studies what could be explained by high criterion at the time of defining of the samples and selection of the examinees.

Investigating the symmetry of the right and left part of the face was noticed that in some cases...
top of the nose or mid of the chin are in deviation in respect to mid line of the face. (Graphic 1,2) All registered deviations were <1.7 mm. That means that deviations within those dimensions are clinically difficult to notice. Such results are in accordance with those found by Rifkin and Paul. (17, 18).

On the photos were analyzed parallelism of the line which we drawn on the incisal edges of the central incisors with the lines which connect mid of the eye pupils. Those two lines are considered reference lines in determination of horizontal symmetry of the face. In 73 examinees or 90% of samples those two lines were parallel, (Graphic 5) which is close to results of Soares et al. (12)

In order to investigate if there are differences in the facial symmetry (for all three indicators, i.e. detail vertical symmetry of the face, correspondence of the mid of the face and mid of the teeth and parallelism of incisal and inter pupilar line) in respect to gender, we have applied the statistical procedure hi-square test ($\chi^2$). This test showed that none of the indicators of the facial symmetry statistically differ per gender ($p > .30$).

### 4. CONCLUSION

This research proved that deviation of the mid of teeth, chin and nose from the mid of the face which are below 2 mm does not have crucial effect to the aesthetic of the face. Measurements and analysis on the digital photos, together with using of respective software tools, make easier diagnosis and planning of treatment in aesthetic dentistry. Another advantage of digital photogrammetry is the opportunity to preserve the material, which allows to repeat the measurements anytime and to add new parameters in latter measurements. Method of the measurement and analysis applied in this research is simple and practical, does not require high IT knowledge and implementation of expensive program packages.

### REFERENCES


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