

Development of new facial three dimensional evaluation method –Quantitative evaluation of facial morphology by homologous modeling–

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Introduction: Recently, “homologous modeling” is frequently adopted as a new quantitative evaluation method of the face on the study field of human morphometry. In this research, three dimensional (3D) models of smile and straight faces from same persons were converted into homologous models and investigated to distinct smile and straight faces by the principal component analysis (PCAs).

Materials and Methods: Twenty-two volunteers (19 males and 3 females, 22 smile and 22 straight faces) who had no medical history cooperated with us for this research. The experimental protocol was approved by the ethics committee of Kyushu University medical campus. Volunteers were photographed to create smile and blank looks by the VECTRA 3D, and each data from them was converted into STL file and redundant regions, e.g. neck, hair and so on, was removed by an editorial software. Nine highly anatomic reproducible landmarks on the surfaces were plotted to trace changes in the expressions. Each homologous model was manufactured to lay over those with a generic face, which was a standard model depending on the 9 landmarks. Then, the PCAs was performed and its components that can distinguish between homologous models of smile and straight faces were searched.

Results: From 1st to 8th components of PCA could estimate over 78% in the all. The 2nd and 6th component showed significant differences between smile and straight faces. Both elements influenced homologous models in raising up or drooping of eyelid and cheilion. But the 2nd component seemed to influence in size of facial contour more.

Discussion: These findings showed that the 6th component of PCA influenced most strongly between smile and straight faces. It was suggested that the homologous models reconstructed by the single component of PCA would be useful to analyze the movement of landmarks' quantitatively.