Volumetric analysis of peri-implant tissue change 5 years after single implant placement in the aesthetic zone. Validating an innovative 3D method.

Abstract

Background: The evaluation of volumetric stability of peri-implant tissue is becoming more and more important in implant therapy because it is invaluable for assessing the long-term success of interventions. In the literature, many different methods have been proposed for evaluating tissue changes over time following different implant and tissue regeneration procedures. Technological progress offers new 3-dimensional methods for visualising and evaluating volumetric changes based on optical scans. *Aim*: The aim of this study was to validate an innovative 3D volumetric method proposed by Lee et al., 2020, for evaluating tissue changes, by comparing the results of this method in which the scanned peri-implant surfaces were transformed and analysed as 3D objects, with the results reported by an existing method based on the calculation of the mean distance between measured surfaces. The null hypothesis was that the two methods provide equivalent results. Additionally, the present study evaluated peri-implant tissue changes 5 years after single implant placement in the aesthetic zone. *Materials and Methods:* Both methods were applied to 11 oral casts taken from 11 patients at crown placement at the implant site (6 upper central implant sites, 5 upper lateral sites) and at follow-up examinations 5 years later. The methods are based on digital workflows in which the master and 5-year follow-up dental casts are scanned and the resulting STL (Standard Tessellation Language) files superimposed for three regions of interest (mesial papilla, central area, distal papilla). The volumetric changes reported by the 3D method of Lee et al. and mean distance method were calculated and compared using the Spearman Rho correlation coefficient (significance level $p<0.01$) and the Wilcoxon signed-rank test (significance level $p<0.05$). The correlation between the two sets of measurements was very high (Spearman Rho correlation coefficient = 0.885). The new volumetric method indicated a mean volume loss of $2.82mm^3$ (SD: 5.06), while the method based on the measurement of mean distance showed a mean volume loss of $2.92mm^3$ (SD: 4.43, Wilcoxon signed-rank test result: $p=0.77$). *Results:* No statistically significant difference was found. The two methods gave equivalent results, and the null hypothesis was not rejected. *Conclusion:* The new volumetric method was validated and can be considered a valuable and trustworthy tool.