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Soft tissue changes during orthopedic therapy: An in vivo 3-dimensional facial scan study

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Introduction: The aim was to compare the soft tissue changes in pretreatment and posttreatment facial scans of patients who had undergone various orthopedic treatments vs a control group of untreated growing patients. **Methods:** Facial scans were performed before (T0) and after (T1) orthopedic treatment in 15 patients prescribed rapid palatal expander (RPE), 15 cervical headgear (HG), and 15 facemasks (FM), as well as 6 months apart in 15 untreated growing patients. After best-fit scan alignment using Geometric Control X software (3D Systems Inc, Rock Hill, SC), a 3-dimensional (3D) analysis of soft tissue changes was performed, comparing 3D reference points (total 22) and 8 areas on T0 and T1 scans. Kruskal-Wallis nonparametric tests and pairwise comparison with Bonferroni's correction were applied to identify any statistically significant differences among groups ($P < 0.05$). All analyses were conducted with SPSS software (version 28; IBM, Armonk, NY). **Results:** At T1, reduced soft tissue projection was found at the nose and upper lip in the HG group, the lower lip in the HG and RPE groups, and the chin in the FM and RPE groups. The RPE group displayed a statistically significant increase in facial divergence, confirmed by gnathion position (RPE vs FM [$P = 0.018$] and RPE vs control [$P = 0.046$]), as well as an increase in the soft tissue projection of both cheeks (left cheek in range of 1-2 mm [$P = 0.030$] and range of 0 to −1 mm [$P = 0.022$]; right cheek in range of 1-2 mm [$P = 0.003$] and range −1 to −2 mm [$P = 0.001$]). There were no clinically significant differences among groups in mandibular right and left body areas. **Conclusions:** The 3D facial analysis revealed significant differences in soft tissues among orthopedic treatments, especially at the upper and lower lip and chin areas, as compared with untreated patients. (Am J Orthod Dentofacial Orthop 2024;■:■-■)

Soft tissue assessment is essential in medicine, and dentistry in particular. Various means of quantitatively and qualitatively describing soft tissue profiles have been proposed, but in orthodontics, the most commonly used method is facial photography. Although this enables the determination of the facial size (length and width), shape, and profile, a 2-dimensional (2D) image of the facial surface is unable to provide any information on depth or volume, making it unsuitable for assessment of facial deformity or asymmetry.[1] This is better achieved by noninvasive optical scanning 3-dimensional (3D) approaches, such as cone-beam computed tomography and 3D face scanners.[2-4] Face scanners capture a series of 3D images of the patient's face and convert them into high-precision digital models, allowing a more accurate description of facial morphology, proportions, and asymmetry.[1] Moreover, face scanners allow volumes and areas to be measured in 3 dimensions during the patient's entire treatment and growth.

To determine the most appropriate treatment plan for each patient, orthopedic therapy, in particular, must be grounded on an accurate evaluation of a young patient's skeletal and dental relationships and facial soft tissues. Indeed, the soft tissues, especially the lips, cheeks, chin, and nose, significantly influence the esthetics of the face and the relationship with the underlying dental and skeletal structures.[1,5] Therefore, orthodontic/orthopedic treatment planning must take into account not only skeletal but also soft tissue changes.[5] Imbalances in the growth of ≥1 part of the craniofacial structures can lead to esthetic and