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Analysis of orofacial tissue pressure and quality of life in adult women undergoing hyaluronic acid lip fillers

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ABSTRACT

Objectives: Maintaining the symmetry and thickness of the lips is vital for well-being and quality of life, since disharmony, often common in the adult female population, intensifies with aging, affecting esthetic perception and orofacial function. This longitudinal study aimed to analyze orofacial tissue pressure (tongue, lips, and cheeks) before (I), 30 days (II), and 60 days (III) after lip augmentation in adult women, in addition to evaluating their perceived quality of life.

Material and Methods: Twenty-two women (mean age 35.4 ± 12.3 years) with normal occlusion participated. Orofacial tissue pressure was measured using the Iowa oral performance instrument (IOPI). Quality of life was assessed using the Glasgow Benefit Inventory (GBI) questionnaire. Hyaluronic acid was the material used for augmentation. Data were analyzed using repeated measures analysis of variance and Bonferroni correction ($P < 0.05$). Descriptive frequency analysis of the GBI data was performed, including mean, standard deviation, median, and quartiles (25–75%).

Results: There was a reduction in tongue pressure after 60 days (I vs. III, P = 0.002) and an increase in right cheek pressure after 30 days (I vs. II, P = 0.04). Left cheek pressure gradually increased (I vs. II, $P = 0.05$; I vs. III, $P = 0.02$). The mean GBI score was 27.4 (20.4), with the general health, physical/ health, and social domains scoring 28.4 (20.3), 28.0 (20.1), and 25.7 (26.0), respectively.

Conclusion: The study suggests functional adaptations in orofacial tissues and an improvement in quality of life following lip augmentation in adult women.

Keywords: Hyaluronic acid, Lip, Orofacial tissue, Quality of life

INTRODUCTION

In recent years, facial esthetic fillers, particularly lip fillers, have become significant not only for enhancing beauty but also for improving the quality of life for adults worldwide.[1] As esthetics gain importance in the perception of well-being and self-esteem, the demand for interventions that promote facial symmetry and harmony is increasing.[2,3] This trend reflects a growing awareness of how appearance influences self-image and social interactions.[4] Therefore, understanding the impacts of these interventions on daily life is essential, especially among a population that values esthetics as an integral part of their emotional and physical health.

This emphasis on lip esthetics is closely linked to orofacial function, where lip morphology and tongue function play important roles in the craniofacial system.[5] Adequate lip volume is

essential not only for sealing the oral cavity but also for controlling internal pressure, key elements for processes such as respiration, swallowing, and phonation.[6,7]

Studies show that strengthening the tongue improves this pressure during swallowing, suggesting that specific exercises may prevent oropharyngeal disorders.[8] Thus, the interaction between the lips and tongue is vital for orofacial health, as the tongue plays an active role in sound articulation, food manipulation, and maintaining oral balance.[9] Changes in lip volume that affect tongue tone can impair functions such as chewing and phonation.[10]

In recent years, hyaluronic acid lip fillers have become popular in facial esthetics for adding volume, hydration, and reducing wrinkles around the mouth, valued for their water-retention ability and biocompatibility.[11] After application, it is essential to assess the results obtained using tools that measure patient satisfaction and perceived benefits.[12] The Glasgow Benefit Inventory (GBI) is presented as an effective tool for this assessment, allowing healthcare and esthetic professionals to collect data on patients' perceptions regarding treatment outcomes.[13]

This study aimed to analyze the pressure of orofacial tissues (tongue, lips, and cheeks) in adult women before and after (30 and 60 days) hyaluronic acid lip fillers and assess quality of life perception 60 days post-procedure. The Iowa Oral Performance Instrument, a reliable tool for quantifying orofacial function, was used to measure tissue pressure.[14] The null hypothesis is that there are no significant differences in the pressure of orofacial tissues at different time points following lip filling with hyaluronic acid and that the impact on quality of life will not be positive.

MATERIAL AND METHODS

Study design and sample selection

This longitudinal study was conducted between June 2022 and March 2024 at the Ribeirão Preto School of Dentistry, University of São Paulo, Brazil. It was approved by the Ethics Committee of the Faculty of Dentistry at Ribeirão Preto, University of São Paulo, Brazil (protocol #10589419.0.0000.5419). All participants provided informed consent before their involvement in the study. Participants were recruited through an open invitation to the local community and surrounding areas. Those who received lip fillers were monitored at three stages: before the procedure (I), 30 days after (II), and 60 days after (III).

For sample size calculation, G*Power 3.1.9.2 software (Franz Faul, University of Kiel, Germany) was used. The calculation was based on a priori testing, adopting a significance level of $\alpha = 0.05$, an effect size of 1.26, and a statistical power of 84%, based on results from a pilot study involving 5 participants. The minimum required sample size was determined to be 10 participants. Of the 50 women initially evaluated, 22 were selected for lip filling with hyaluronic acid, following specific inclusion and exclusion criteria. Participants were aged between 20 and 59 years (mean age 35.4 ± 12.3) and exhibited normal occlusion. All participants had a complete natural dentition, except for the third molars.

Exclusion criteria included women exhibiting signs or symptoms of temporomandibular dysfunction, experiencing mental or physical discomfort during evaluations, mouth breathing, having third molars, or suffering from muscular or stomatognathic system pathologies. Other exclusions were mixed breathing patterns, lip incompetence, use of muscle relaxants, undergoing speech therapy, myofascial or otorhinolaryngological therapy, recent orthodontic treatment (within the last year), current use of orthodontic appliances, or a history of previous lip fillers. The lip-filling procedure was conducted by a specialist in orofacial harmonization, ensuring standardized techniques and safety during interventions.

Hyaluronic acid application technique

Restylane® Kysse (Galderma SA, Lausanne, Switzerland), containing 20 mg/mL of hyaluronic acid, was used according to Blandford *et al*.'s technique.[15] Safe microcannulas up to 25 G were employed. Each participant underwent a medical history review and laboratory tests to assess oral and general health. Antisepsis of the orofacial region was done with 1% hydrogen peroxide, followed by cleaning with 2% chlorhexidine or 70% alcohol (used in a specific case). A biosafety protocol was followed, including gowns, caps, and masks.

For local anesthesia, lidocaine hydrochloride or mepivacaine was used. Access for the procedure was achieved with a 24 G needle, followed by the introduction of a 25 G microcannula, and for some injections, a 30 G needle was used. All injections were administered by the same professional, respecting anatomical proportions. The hyaluronic acid, which is low molecular weight and approved by the Federal Drug Administration, was chosen due to the high mobility of the area, minimizing the impact on lip biomechanics.[16] It was applied superficially above the orbicularis muscle, injecting 0.6 mL into the upper lip and 0.4 mL into the lower lip, considering the anatomical differences between the lips.

Analysis of orofacial tissue pressure

To measure the pressure of orofacial tissues (tongue, lips, and cheeks), the Iowa oral pressure instrument (IOPI) was utilized. The device features a plastic bulb connected to a pressure transducer through a tube. The IOPI detects changes in pressure (kPa) when the bulb contacts the lips, tongue, and

cheeks (both right and left), allowing for the measurement of maximum pressure during voluntary isometric contraction.

Participants were instructed to sit comfortably in a chair, with their legs uncrossed and hands resting on their thighs. After a detailed explanation of the procedure, the plastic bulb was positioned by the calibrated researcher.[17] The measurements were taken in triplicate to obtain a reliable average, following the methods described below.

To measure lip pressure, the bulb was placed between the upper and lower lips of the participant, who, with teeth in occlusion, was instructed to press the bulb maximally for 3 s without suction. For tongue pressure, the bulb was positioned against the palatal surface of the upper central incisors, and the participant was instructed to elevate the tongue and press the bulb against the hard palate, maintaining maximum pressure for 3 s. For cheek pressure, the bulb was positioned between the teeth and the cheek in the area corresponding to the vestibular surface of the posterior teeth, with instructions to maintain maximum pressure for 3 s. A 30-s interval was established between each data collection, during which participants were encouraged to exert maximum effort. Pressure values were recorded based on the highest pressure achieved in each of the three measurements.

Quality of life analysis

The GBI was the instrument used to quantify health-related benefits resulting from lip filling in relation to quality of life. Participants answered questions based on their own experiences and perceptions, using a five-point Likert scale ranging from "much worse" to "much better" or from "very dissatisfied" to "very satisfied."

The questionnaire was administered 60 days after the lip-filling procedure and included multiple-choice questions for simplicity and clarity. Twelve questions focused on general health changes, including psychosocial aspects, categorized as "general." Three additional questions addressed the level of social support needed for the condition. The final three questions explored changes in physical health, such as medication use and the number of medical or dental consultations since the procedure.

The total GBI score was determined based on the responses provided by participants, offering insights into the impact of the interventions on quality of life. For each subscale (General, Social, and Physical/Health), the scores attributed to the respective questions were summed. The total for each subscale was then divided by the number of corresponding items: 12 questions for General Well-Being, 3 for Social Well-Being, and 3 for Physical/Health Well-Being. The overall GBI score was obtained by averaging the three subscales, ranging from −100 to +100. A positive score indicated a perceived improvement in quality of life following the lip intervention, while a negative score indicated a decline. A score of 0 signified no perceived change in quality of life.[12,18]

Statistical analysis

After collecting data on orofacial tissue variables (tongue, lips, and cheeks), the Shapiro–Wilk normality test indicated a normal distribution. Statistical analysis was performed using statistical package for the social sciences (SPSS) software, version 20.0 (SPSS Inc., Chicago, IL, USA). A repeated measures analysis of variance with Bonferroni correction was used, setting a significance level of 5% ($P < 0.05$) for the orofacial tissue data. In addition, a descriptive frequency analysis of the GBI data was conducted, including calculations for mean, standard deviation (SD), median, and quartiles (25–75%).

RESULTS

Table 1 presents the results of orofacial tissue pressure (lips, tongue, and cheeks) at the time points before, 30 days after, and 60 days after lip filling. Significant differences were observed in tongue pressure, which decreased after 60 days (I vs. III, $P = 0.002$), and in right cheek pressure, which increased after 30 days (I vs. II, $P = 0.04$). Left cheek pressure gradually increased over time (I vs. II, $P = 0.05$ and I vs. III, $P = 0.02$).

Table 2 shows the scores from the GBI, reflecting the perception of quality of life 60 days' post-esthetic lip intervention. The overall mean GBI score was positive, indicating an improvement in quality of life. Results in the domains of General Health, Physical/Health, and Social also showed favorable variations. In addition, the median GBI scores revealed positive values in the General Health, Physical/Health, and Social domains.

DISCUSSION

The null hypothesis of this study was rejected due to the significant differences in orofacial tissue pressure (tongue and cheeks) observed between the different time points following lip filling with hyaluronic acid, as well as the positive impact on quality of life.

Sixty days after lip filling, a significant reduction in tongue pressure was observed, indicating functional adaptation in the orofacial system. This result suggests a compensatory response to the increased lip volume caused by hyaluronic acid, which may alter the dynamics of the tongue.[19] Studies show that changes in lip morphology affect tongue posture and pressure,[10] confirming the findings of this study. Although volumetric measurements of lip volume using three-dimensional photography were not performed in this

Table 1: Differences in mean values (± standard error) and pressure of the lips, tongue, and cheeks (right and left) before, 30 days, and 60 days after hyaluronic acid lip filler.

Pressure orofacial tissues	Periods			*P*-value	*P*-value (Bonferroni)		
	I	II	III		I versus II	I versus III	II versus III
Lips	6.59±0.40	7.39±0.62	6.09±0.55	0.16	-	-	-
Tongue	44.18±1.43	42.04±1.28	38.13±1.86	0.000	-	0.002	-
Right Cheek	12.00±1.39	15.18±1.52	13.72±1.64	0.04	0.04	-	-
Left Cheek	10.54±1.44	13.45±1.40	14.95±1.96	0.002	0.05	0.02	-

I: Before, II: 30 days, III: 60 days. Significant differences measured by repeated measures (ANOVA) and Bonferroni correction ($P<0.05$). ANOVA: Analysis of variance

Table 2: Mean values, SD, median, and quartiles (25–75%) of the GBI scores along with their respective subdomains.

GBI	Mean (SD)	+27.4 (20.4)
	Median (25–75%)	+24.3 (15.9–30.5)
GBI subdomains		
Overall	Mean (SD)	+28.4 (20.3)
	Median (25–75%)	+27.8 (0–33.3)
Physical/health	Mean (SD)	+28.0 (20.1)
	Median (25–75%)	+16.6 (16.6–33.3)
Social	Mean (SD)	+25.7 (26.0)
	Median (25–75%)	+16.6 (0–33.3)

GBI: Glasgow benefit inventory, SD: Standard deviation

study, it is known that 1 mL of hyaluronic acid was used, with 0.6 mL in the upper lip and 0.4 mL in the lower lip, respecting the natural morphology.

Lip filling with hyaluronic acid appears to influence cheek pressure, as evidenced by the increase in pressure in the right cheek after 30 days and the gradual increase in the left cheek over time. This phenomenon may be explained by the adaptation of orofacial musculature to the new volume provided by the filled lips. In addition, the esthetic intervention may lead to physiological and biomechanical changes in the facial tissue, contributing to modifications in the force exerted by the cheeks.

Hyaluronic acid is a dermal filler that, when applied, increases lip volume due to its ability to attract and retain water, resulting in tissue expansion around the treated area.[11,20] This increase in volume could create passive tension in the facial muscles around the lips, such as the orbicularis oris, leading to modifications in the muscular biomechanics of the entire perioral region.

The muscles of the cheek, such as the buccinator, are closely related to the labial musculature,[21] and the increase in lip volume could promote greater activation and recruitment of these muscles. This muscular phenomenon may manifest as an increased perception of force in the cheeks, due to greater activation of facial muscles during daily activities such as chewing and speaking, caused by the tension from lip expansion.

In addition, hyaluronic acid may modify neuromuscular sensory feedback in the facial region, leading to improved motor control and enhanced reflex activation of the muscles.[22] Over time, this more efficient muscle activation could be perceived as an increase in strength. Furthermore, by filling areas that have lost volume due to aging, such as the lips, hyaluronic acid can offer additional anatomical support to the cheeks, enabling the muscles to function in a more coordinated and efficient manner.[23]

In addition to the functional changes observed in the orofacial tissues, the results of this study demonstrate a significant improvement in the quality of life of the participants. The average score (SD) on the GBI was +27.4 (SD = 20.4). A positive score suggests a perceived improvement in quality of life following the esthetic intervention. The results of this study are consistent with the evidence presented in the medical literature, particularly concerning the total average score of the GBI.

A specific study examined chronic peripheral facial nerve paralysis, particularly affecting the frontal branch, which leads to brow ptosis and eyelid deformities, resulting in restricted vision and loss of facial symmetry. After undergoing a minimally invasive endoscopic brow and forehead lift surgery, participants with facial paralysis reported a significant improvement in quality of life, with an average increase of +29.2 (SD = 13.6).[24]

Using the GBI, patients reported changes in self-esteem, quality of life, and satisfaction with their appearance. In this study, the scores for General Health, Physical Health, and Social Health were +28.4 (SD = 20.3), +28.0 (SD = 20.1), and +25.7 (SD = 26.0), respectively. These positive results align with existing literature, which shows an average score of +29.6 (SD = 26.1) on the GBI, with specific scores of +36.8 (SD = 29.3) for General Health, +18.0 (SD = 28.1) for Social Health, and +17.7 (SD = 35.3) for Physical Health. These data indicate significant improvements in patients' quality of life, particularly in self-confidence and social engagement, following septal perforation repair.[18]

The increase in self-esteem, as the improved appearance contributes to a significant boost in confidence,[25] and overall satisfaction, as the feedback collected through the inventory often reveals high levels of contentment with the procedure and a willingness to pursue additional treatments.[26] Using the GBI, professionals can not only assess the effectiveness of the treatment but also enhance their approaches based on patient experiences.[27] This feedback is important to ensure the continued improvement of the services offered and the personalization of treatments, always aiming for the well-being and satisfaction of the patient.

In this study, the overall average of the GBI, along with positive changes in the subdomains of General Health, Physical Health, and Social Health, suggested that participants experienced benefits beyond esthetics, encompassing functional and social aspects. This enhancement in quality of life can be linked to satisfaction with their appearance post-procedure, which directly impacts self-esteem and emotional well-being.[28] The improved perception of physical and social health may be associated with increased confidence in social interactions and greater personal satisfaction with appearance.

A published study highlighted that patients who underwent esthetic surgeries reported significant improvements in both satisfaction with their appearance and psychological well-being. The research showed that facial esthetic interventions increase self-esteem, reduce anxiety, and improve body perception.[29] The positive effects, such as increased social and emotional confidence, were observed particularly in patients with pre-operative conditions characterized by discomfort with body image.

While most research on lip fillers emphasizes esthetic outcomes, it is essential to also explore the psychological and social impacts of these procedures. The reported improvements in quality of life scores suggest that esthetic interventions can extend beyond physical benefits, positively affecting mental health and social well-being.[30] This consideration is vital for clinical practice, as it indicates that professionals in esthetic procedures should address the psychological and social effects when discussing expectations and outcomes with patients. Many patients seek these treatments not only to enhance their appearance but also to improve their self-esteem and self-confidence, ultimately leading to a better quality of life.[31]

The results of this study have important clinical implications. Changes in orofacial tissue pressure indicate that healthcare professionals performing lip filler procedures should consider not only the immediate esthetic effects but also the potential functional changes in surrounding tissues. These changes may require adjustments in therapeutic approaches and post-procedure care to maximize the benefits of lip fillers while preserving orofacial functionality.

Moreover, the positive impact on the quality of life of the participants underscores the importance of considering the psychological and social aspects of esthetic procedures. The increase in self-esteem and satisfaction with appearance can have lasting effects, contributing to the overall well-being of patients. This finding reinforces the need for an integrated approach in clinical practice, where both the physical and mental health of patients are equally valued.

This study has limitations that should be acknowledged. First, the small sample size of 22 participants may restrict the generalizability of the findings. In addition, the study did not evaluate the increase in lip volume following the administration of lip fillers. This aspect is particularly relevant, as changes in lip volume can influence not only esthetic outcomes but also functional aspects of oral dynamics, including swallowing and speech. Another limitation pertains to the inclusion of women across different age groups. Variations in skin elasticity and tissue tone associated with aging may affect the response to fillers, potentially leading to differences in hyaluronic acid absorption and subjective perceptions of the results. These age-related factors could introduce variability in the data. Stratifying participants by age group or focusing on a narrower age range would likely enhance the precision and applicability of the study's findings.

Future research should involve larger samples to verify findings across diverse populations. Additional studies could examine the long-term effects of lip fillers on orofacial function and patient quality of life. It would also be valuable to explore how various types of fillers, differing in volume and composition, impact orofacial tissues and patient well-being.

CONCLUSION

The study's data indicate that hyaluronic acid lip fillers led to significant functional adaptations in orofacial tissues, including the tongue and cheeks, positively impacting patients' quality of life. Beyond esthetic advantages, the procedure also provided functional and psychological benefits, underscoring its clinical importance. Understanding these adaptations and their connection to quality of life is important for informing clinical practices and improving patient satisfaction, highlighting the need for an integrative approach to orofacial esthetics.

Authors' contributions: Conceptualization: Mirella Milla Marino, Selma Siéssere, Simone Cecilio Hallak Regalo and Marcelo Palinkas; Investigation: Mirella Milla Marino, Nicole Barbosa Bettiol, Paulo Batista de Vasconcelos, Reinaldo Luiz Brunello Junior, Alice Helena de Lima Santos Cardoso and Thamyres Branco. Methodology: Mirella Milla Marino, Selma Siéssere, Lais Valencise Magri, Jardel Francisco Mazzi-Chaves, Simone Cecilio Hallak Regalo and Marcelo Palinkas; Data curation: Mirella Milla Marino and Marcelo Palinkas.;

Validation: Selma Siéssere, Simone Cecilio Hallak Regalo and Marcelo Palinkas; Writing-original draft preparation: Mirella Milla Marino and Marcelo Palinkas; Writing-review and editing: Lais Valencise Magri, Jardel Francisco Mazzi-Chaves, Selma Siéssere and Simone Cecilio Hallak Regalo; Supervision: Marcelo Palinkas and Simone Cecilio Hallak Regalo. All authors have read and agreed to the published version of the manuscript.

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Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent.

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