RESEARCH ARTICLES

Globosci

Woman's Lips Evaluation Throughout The 20th Century: Aesthetic Analysis of The Lower Third of The Face

Lucia Giannini[1,2], **Guido Galbiati**[1,2], **Gionata Bellucci**[1,2], **Niccolò Cenzato**[*1,2], **Alessandro Bruni**[3] and **Luca Esposito**[1,2]

[1]University of Milan Department of Biomedical, Surgical and Dental Sciences, Via Commenda 10 (20122), Milan, Italy.

[2]Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Maxillo-Facial Surgery and Dental Unit, Via Commenda 10 (20122), Milan, Italy.

[3]Surgical, Medical and Dental Department of Morphological Sciences related to Transplant, Oncology and Regenerative Medicine, University of Modena and Reggio Emilia, Via del Pozzo 71 (41124) Modena, Italy.

*Correspondence to: Niccolò Cenzato, University of Milan Department of Biomedical, Surgical and Dental Sciences, Italy; Email: Niccolo.cenzato@unimi.it

How to cite: Giannini, L., Galbiati, G., Bellucci, G., Cenzato, N., Bruni, A. and Esposito, L. Woman's Lips Evaluation Throughout The 20th Century: Aesthetic Analysis of The Lower Third of The Face. *BME Horizon*, 1(3). DOI: https://doi.org/10.37155/2972-449X-vol1(3)-83.

Abstract: The aim of this study consists in evaluating the change in aesthetic face parameters throughout the 20th century. Only the lower third of the face, especially the lips, has been considered. Pictures from fashion magazines published throughout the 20th century were collected. Fashion magazines were chosen as the source for such pictures, as fashion models often reflect the beauty standards of their time. Our selection, being orthodontists and therefore dealing with a specific sector of the face (the lower third), was based on models selected based on the characteristics of their face. A total of 214 orthogonal profile pictures of women were selected. Nguyen's method was selected as it allows for profile analysis without a reference grid. All data was compiled on an excel sheet and analyzed through the SPSS 11.0 software. Models were divided into two groups: from 1920 to 1949 and from 1990 to 2023. A t-test was performed. The significance level was P < 0.05. Regarding the comparison between the mean ratio from group 1 (from 1920 to 1949) and from group 2 (1990-2023), a statistically significant difference was found (P < 0.05): the increase in time of this ratio as a criterion for exceptional beauty is statistically significant. This research demonstrated that there is a statistically significant difference in the labial area/naso-labial-chin area ratio between early 20th century models and late

20th century models and that in this century we assisted a change in standards of beauty where a more protruded profile is preferred.

Keywords: Lower Third of The Face; Profile Analysis; Labial Area; Naso-Labial-Chin Area, Orthodontics Evaluation

1. Introduction

Knowledge of aesthetic parameters is a primary objective for an orthodontist as it determines many aspects of the orthodontic treatment. The aim of an orthodontic treatment is to obtain a normal class I occlusion, good overjet and overbite and stability of the results through time. Many patients, however, ask for orthodontic therapy because of their esthetic issues which go hand in hand with malocclusions [1-3].

In this context, a careful evaluation and analysis of the aesthetic canons of the lower third of the face fits very well, in particular of the lips, which is the one that is impacted and often modified during an orthodontic treatment.

Nowadays, globalization, mass media and social networks have made a person's appearance a fundamental aspect of social interactions, and beauty standards have also been suddenly modified in the span of a few decades.

Although the aesthetic canons change over time and, as the years go by, different parameters and needs emerge to follow and strive for, in the Caucasian breed, perfectly aligned teeth, prominent mandibular lines, and protruded lips seem to be nowadays standards for beauty [3].

In recent years in particular labial aesthetics has assumed great importance, so much so that many of patients turn to the orthodontist, expressly asking to correct the position of the dental elements in order to improve the relationship of the lips (e.g. palatinized upper or buccalized lower incisors). For this reason, this work focuses on the lips profile and on the factors that can influence it and that interest the orthodontist who aims, among others, to improve it.

In the orthodontic field, cephalometric analysis and even more specifically the analysis of the soft tissues of the face, assume a fundamental importance.

At the beginning of the 20th century, Tweed's Diagnostic Triangle defined new standards for facial esthetic parameters which influenced orthodontic treatments for a good part of the century [4-8]. Tweed observed that if the Frankfurt Mandibular Incisal Angle (FMIA) is between 60° and 70° after orthodontic treatment, the patient s profile will be balanced and harmonious [7,8]. Following these observations, it could be concluded that the position of inferior incisors is fundamental in determining the best treatment outcome. Merrifield, in 1966, published his work [9] on the esthetic balance and harmony of a profile which refuted Tweed's theory by defining the Z angle, located between Frankfurt's plane and the line between the Pogonion and the most protruded lip. This angle has been essential for measurement and prediction of soft tissue changes following orthodontic treatment [9].

Ricketts cephalometric analysis [10, 11] includes an esthetic evaluation using the E line: this line is tangential to the cutaneous pogonion and the tip of the nose; the lower lip should be 2 mm behind this line and never cross it. Ricketts used golden ratio proportions in order to describe ideal esthetic parameters such as nose width, mouth width, lip volume and nose length [12, 13] and observed that the upper lip thickness increased 1 mm for every 3 mm of maxillary incisor proinclination [14].

Cephalometric analysis is essential for diagnosis, treatment planning, and hard and soft tissue movement prediction. The only downside is that this analysis does not consider static and dynamic relations between hard and soft tissues, and that soft tissues are heavily influenced by age and everyday habits. The modern approach to dentofacial analysis includes a soft tissue and skeletal analysis, evaluating them in both their static and dynamic components [3].

Arnett and Bergman [15, 16] in their analysis of facial keys, suggest that lip thickness is decisive for orthodontic and surgical treatment response: the nasolabial angle, for instance, is important for acceptable profile esthetics and thin lips (between 6 and 10 mm) can be repositioned further than thick lips (between 12 and 20 mm). Lip tension is also an important factor: tenser lips might move more with backward teeth movement and less with forward teeth movement.

Nguyen et al. [17] proposed a method to evaluate the

position and the area occupied by lips: two areas, Area A and Area B, are considered; their ratio expresses how much of the lips occupy the lower 1/3 of the facial profile. Following this reasonining the study focused not only on the mere evaluation of the lips and their profile, besides the soft tissue pogonian point and the pronasal point that belong to the lower third of the face influence our study.

Area A is determined by five points: Upper vermillion border point, upper lip anterior point, lower lip anterior point, lower vermillion border point and lip commissure point. Area B is determined by three points: Pronasal point, soft tissue pogonion point and lip commissure point (**Figure 1**).
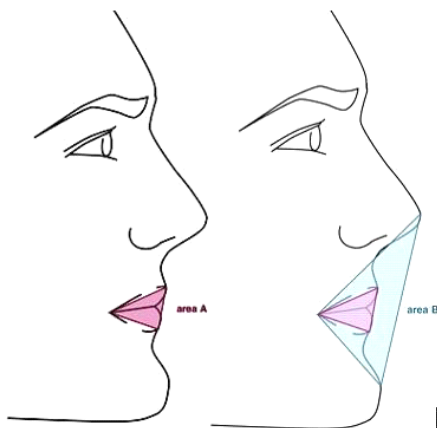
Figure 1. Nguyen s method.

The biggest quality of Nguyen's analysis is that it provides a tool for analyzing pictures and profiles taken orthogonally but without any grid reference.

In the future, virtual study models may be helpful in simulating orthodontic treatment results and analyze esthetic parameters in different, perhaps better, ways [18-21]. Studies on tridimensional cephalometric analyses showed that new technologies, once developed accordingly, may become essential for treatment planning [22]. Augmented reality might also become the "new norm", once the technology allows the orthodontist to directly visualize the treatment results on a patient [23].

The objective of this study is to evaluate the changes in beauty standards for a person's profile throughout the 20th century, mainly regarding lip thickness and protrusion.

2. Materials and Methods

In order to evaluate the change in aesthetic parameters throughout the 20th century, research for profile pictures of women considered aesthetically pleasing at the time when the picture was taken was conducted: major fashion magazines distributed in Europe were chosen as the source for such pictures, as fashion models often reflect the beauty standards of their time. Pictures from fashion magazines published throughout the 20th century were collected thanks to the archives in Polimoda's library (Florence, Tuscany, Italy). Our selection, being orthodontists and therefore dealing with a specific sector of the face (the lower third), was based on models selected based on the characteristics of their face.

The inclusion criteria were:
• Acceptable picture quality.
• Inferior 1/3 of the face clearly visible
• Adequate labial competency
The exclusion criteria were:
• Unacceptable picture quality.
• ¾ profiles.
• Inadequate labial competency.
• Smiling profiles.

A total of 214 orthogonal profile pictures of women were selected.

Because of the absence of a reference grid, classic methods such as Ricketts E line and Arnett's True Vertical Line could not be used: Nguyen's method [17] was selected as it allows for profile analysis without a reference grid. Following guidelines described by Nguyen and using the program "Orthocad by A.D'Ottavio", an italian program awaible at the University of Milan, both Area A (Labial) and Area B (nose-lip-chin) were measured for each profile: this allows for precise calculation of the amount of labial tissue present in the inferior 1/3 of the face.

This area is included in a polygon with its apexes being:
• C: lip commissure point
• UVB: upper vermillion border point
• ULA: upper lip anterior point
• LLA: lower lip anterior point
• LVB: lower vermillion border point
Another volume examined was the nose-chin area included in a polygon with its apexes being:
• C: lip commissure point
• PC: cutaneous pogonion point
• PN: pronasal point
Once both areas were obtained, the ratio between

Area A and Area B was calculated according to Nguyen's method. All measurements were performed by the same operator.

Statistical Analysis

All data was compiled on an excel sheet and analyzed through the SPSS 11.0 software. The Student s T-test was chosen to compare profile values from group 1 (from 1920 to 1949) and from group 2 (1990-2023). The significance level was P < 0.05.

3. Results

The mean ratio between Area A and Area B for each decade was calculated. A constant growth of this ratio can be seen throughout the years, without stationary phases.

Regarding the comparison between the mean ratio from group 1 (from 1920 to 1949) and from group 2 (1990-2023), a statistically significant difference was found (P < 0.05): the increase in time of this ratio as a criterion for exceptional beauty is statistically significant.

4. Discussion

Although the current study is focused on Caucasian ethnicity, it has been observed that different ethnicities show different perceptions of beauty and different expectations for orthodontic treatment results [9,13].

Sutter et al. [19] reported that the perception of beauty in Caucasians is shifting toward a "black American" model, with a profile showing more fullness and more protruded lips. Sutter et al. compared four groups: Caucasian models, Caucasian control group, African American models and African American control group; no Caucasian model showed lips behind the E line, demonstrating a tendency to select fuller lips as a characteristic of standard beauty. This can be further highlighted by the frequent use of hyaluronic acid in esthetic procedures aimed to increase lip thickness and fullness [24,25].

Farrow et al. [20] modified four different "black American" profiles with graphic software, and subjected them for evaluation to three different groups: common people (Caucasian and African American), general dentists and orthodontists. The profiles analyzed by these groups were:
- S: straight or white facial profile
- BM1: bimaxillary protrusion 1 (low degree of protrusion)
- BM2: bimaxillary protrusion 2 (medium degree of protrusion)
- BM3: bimaxillary protrusion 3 (severe degree of protrusion)

Both Caucasians and African Americans identified as "most attractive" the BM1 profile. Black Americans seem to prefer a flatter profile compared to their ethnic standard, while Caucasians seem to prefer a more protruded profile compared to their ethnicity s standard. This preference has been confirmed by Polk et al. [21] which observed that Black Americans prefer flatter profiles, even if surgical procedures would be needed for such results.

Based on the results from this research, however, it can be observed that in terms of conventional beauty standards more protruded profiles became more and more popular throughout the 20th century, with a peak in popularity between 1970 and 2000: this may be caused by the higher prevalence of non-white models compared to the first half of the century. Based on these considerations, orthodontic treatments should be oriented towards palatal expansion rather than pre-orthodontic extractions. Studies have shown that Slow Maxillary Expanders (SME) are effective for treating transversal deficiencies with orthopaedic results [26- 30]. Effective, controlled tooth movement using light and constant forces can be obtained using fixed appliances such as the leaf expander [27, 28].

5. Conclusions

This research demonstrated that there is a statistically significant difference in the labial area/naso-labial-chin area ratio between early 20th century models and late 20th century models: this translates in a change in standards of beauty where a more protruded profile is preferred. The change in beauty standards might be correlated to globalization and acceptance of ethnic differences. These results might help general dentists and orthodontists in evaluating patient's esthetic preferences and provide better results based on a well-thought-out treatment plan. In conclusion, the orthodontic treatment of the individual patient must be studied in her individuality with the aim of obtaining not only correct occlusal relationships but also a pleasant facial aesthetic. The decision to plan or not to plan pre-orthodontic extractions can influence a

patient's profile.

Funding

Conflicts of Interest

The authors declare no conflict of interest.

References

[1] Romani K L, Agahi F, Nanda R, *et al*. Evaluation of horizontal and vertical differences in facial profiles by orthodontists and lay people[J]. *The Angle Orthodontist*, 1993; 63(3): 175-182.

[2] Abate A, Gaffuri F, Lanteri V, *et al*. A CBCT based analysis of the correlation between volumetric morphology of the frontal sinuses and the facial growth pattern in caucasian subjects. A cross-sectional study[J]. *Head & Face Medicine*, 2022; 18(1): 1-12.
https://doi.org/10.1186/s13005-022-00308-3.

[3] Farronato G, Galbiati G, Esposito L, *et al*. Three-dimensional virtual treatment planning: Presurgical evaluation[J]. *Journal of Craniofacial Surgery*, 2018; 29(5): e433-e437.
https://doi.org/10.1097/SCS.0000000000004455.

[4] Tweed C H. Indications for the extraction of teeth in orthodontic procedure[J]. *American journal of orthodontics and oral surgery*, 1944; 30(8): 405-428.

[5] Tweed C H. A philosophy of orthodontic treatment[J]. *American Journal of Orthodontics and Oral Surgery*, 1945; 31(2): 74-103.

[6] Tweed C H. The Frankfort-mandibular plane angle in orthodontic diagnosis, classification, treatment planning, and prognosis[J]. *American journal of orthodontics and oral surgery*, 1946; 32(4): 175-230.

[7] Tweed C H. *Clinical orthodontics*, vol 1 and 2. St. Louis: C. V. Mosby, 1966.

[8] Tweed C H. The Frankfort-mandibular incisor angle (FMIA) in orthodontic diagnosis, treatment planning and prognosis[J]. *The Angle Orthodontist*, 1954; 24(3): 121-169.

[9] Merrifield L L. The profile line as an aid in critically evaluating facial esthetics[J]. *American journal of orthodontics*, 1966; 52(11): 804-822.

[10] Ricketts R M. Cephalometric analysis and synthesis. *The Angle Orthodontist*, 1961; 31(3): 141-156.

[11] Ricketts R M. Planning treatment on the basis of the facial pattern and an estimate of its growth[J]. *The Angle Orthodontist*, 1957; 27(1): 14-37.

[12] Ricketts R M. Esthetic, enviroment, and the law of lip relation. *American journal of orthodontics*, 1968; 54: 272-289.

[13] Ricketts R M. Divine proportion in facial esthetics[J]. *Clinics in plastic surgery*, 1982; 9(4): 401-422.

[14] Ricketts R M. Cephalometric synthesis: an exercise in stating objectives and planning treatment with tracings of the head roentgenogram[J]. *American journal of orthodontics*, 1960; 46(9): 647-673.

[15] Arnett G W, Bergman R T. Facial keys to orthodontic diagnosis and treatment planning. Part I[J]. *American journal of orthodontics and dentofacial orthopedics*, 1993; 103(4): 299-312.

[16] Arnett G W, Bergman R T. Facial keys to orthodontic diagnosis and treatment planning— part II[J]. *American journal of orthodontics and dentofacial orthopedics*, 1993; 103(5): 395-411.

[17] Nguyen D D, Turley P K. Changes in the Caucasian male facial profile as depicted in fashion magazines during the twentieth century[J]. *American journal of orthodontics and dentofacial orthopedics*, 1998; 114(2): 208-217.

[18] Favero L, Terrazzani C, Favero V, *et al*. Virtual study models: a comparison of modular application systems[J]. *Progress in orthodontics*, 2009; 10(2): 16-25.

[19] Sutter Jr R E, Turley P K. Soft tissue evaluation of contemporary Caucasian and African American female facial profiles[J]. *The Angle Orthodontist*, 1998; 68(6): 487-496.

[20] Farrow A L, Zarrinnia K, Azizi K. Bimaxillary protrusion in black Americans—an esthetic evaluation and the treatment considerations[J]. *American Journal of Orthodontics and Dentofacial Orthopedics*, 1993; 104(3): 240-250.

[21] Polk Jr M S, Farman A G, Yancey J A, *et al*. Soft tissue profile: a survey of African-American preference[J]. *American Journal of Orthodontics and Dentofacial Orthopedics*, 1995; 108(1): 90-101.

[22] Maspero C, Abate A, Bellincioni F, *et al*.

Comparison of a tridimensional cephalometric analysis performed on 3T-MRI compared with CBCT: A pilot study in adults[J]. *Progress in Orthodontics*, 2019; 20(1): 1-10. https://doi.org/10.1186/s40510-019-0293-x.

[23] Farronato M, Maspero C, Lanteri V, *et al*. Current state of the art in the use of augmented reality in dentistry: A systematic review of the literature[J]. *BMC Oral Health*, 2019; 19(1): 1-15. https://doi.org/10.1186/s12903-019-0808-3.

[24] Maspero C, Gaffuri F, Castro I O, *et al*. Correlation between Dental Vestibular–Palatal Inclination and Alveolar Bone Remodeling after Orthodontic Treatment: A CBCT Analysis[J]. *Materials*, 2019; 12(24): 4225. https://doi.org/10.3390/ma12244225.

[25] Bertossi D, Sbarbati A, Cerini R, *et al*. Hyaluronic acid: in vitro and in vivo analysis, biochemical properties and histological and morphological evaluation of injected filler[J]. *European Journal of Dermatology*, 2013; 23(4): 449-455. https://doi.org/10.1684/ejd.2013.2059.

[26] Gianolio A, Cherchi C, Lanteri V. Rapid and slow maxillary expansion: a posteroanterior cephalometric study[J]. *European Journal of Paediatric Dentistry*, 2014; 15(4): 415-418.

[27] Lanteri C, Lanteri V, Gianolio A, *et al*. A new way for no compliance palatal expansion: the leaf expander[J]. *Journal of clinical orthodontics*, 2016; 50(09): 552-560.

[28] Foschi D, Lanteri C, Abate A, *et al*. Aesthetic recovery of the smile: a new integrated orthodontic-conservative method| Recupero estetico e funzionale del sorriso: un nuovo metodo ortodontico-conservativo integrato[J]. *Dental Cadmos*, 2022; 90(9): 694-705. https://dx.doi.org/10.19256/d.cadmos.09.2022.07.

[29] Lanteri V, Cossellu G, Gianolio A, *et al*. Comparison between RME, SME and Leaf Expander in growing patients: a retrospective[J]. *European Journal of Paediatric Dentistry*, 2018; 19(3): 199-204.

[30] Farronato M, Lanteri V, Fama A, *et al*. Correlation between malocclusion and allergic rhinitis in pediatric patients: a systematic review[J]. *Children*, 2020; 7(12): 260. https://doi.org/10.3390/children7120260.