

LVMH / Quantitative analysis of lip plumpness by 3D fringe projection and microcirculation assessment: A new approach

RECHERCHE
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INTRODUCTION

In our modern society, lips' appearance has a major effect on the aesthetic and attractive perception of the female face, and especially lip plumper.

To quantify this dimension, 3D Fringe projection is one of the few noninvasive methods available for direct lips volume measurement. If the volume is the main visual characteristic associated with plump, it has been suggested that lip plumper enhances lips microcirculation through vasodilation (1). By comparing topographical (3D) and physiological (microcirculation) measurements, we aimed to examine and explain the lip plump aesthetic.

METHODS

Volunteers

Fourteen healthy female volunteers with skin phototype between I and III on Fitzpatrick scale, from 21 y.o to 34 y.o (mean 27± 4.35 years old) were recruited for the study.

Product

A lip Gloss was used for the study. It was applied in use by the volunteers and no specific gesture was required. The efficacy was assessed 45 minutes after the application.

Volumetric parameters

Volumetric parameters have been obtained using the AEVA-HE² 3D Imaging system (Eotech SA, Marcoussis, France) that uses fringe projection and cameras to analyze the geometry of the lips.

Microcirculation assessment

Microcirculation assessment have been obtained using the red plan of Cross-polarized modality thanks to VISIA® (Canfield, Canfield Imaging Systems, Fairfield, NJ). The Microcirculation Index was calculated in order to normalize all the values between 0 and 1 as described :

$$I_M = \left(\frac{1}{\sigma 76} + \frac{100 - L^*}{100} + \frac{C^*}{170} \right) / 3$$

With $\sigma 76$ being homogeneity measurement as calculated below, L^* the Luminosity and C^* the Chroma value.

$$\sigma 76 = \frac{1}{N} \sum_i \sqrt{(L^*_i - \mu_{L^*})^2 + (a^*_i - \mu_{a^*})^2 + (b^*_i - \mu_{b^*})^2}$$

DISCUSSION

Instrumental approaches showed variations (Lip volume and Microcirculation) that reflect the performance of the Lip Gloss. The increasing of the parameters, and their link with the plump effect seems to be in line with the literature (1), but complementary studies (in progress) will allow to sustain it.

We hypothesize the gain of volume on the lips could be due to increased blood vessels, but further investigations will be necessary to confirm it.

CONCLUSION

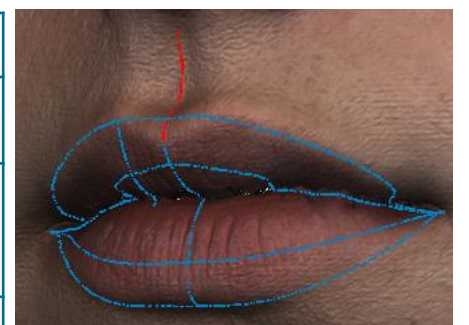
This study convinced us of the possibility of using 3D Fringe projection as a robust method to quantify plumps effects. It also provided us with new elements allowing to explore the lip plump phenomena in a new way.

RESULTS

Thanks to AEVA-HE² 3D Imaging system, we were able to measure 20 parameters of the volunteers' lips and discriminate them into 6 clusters, separated in two classes (primary and secondary) (Table 1). We considered **Global lips volume** as being the most discriminating primary parameter to quantify plump variations, combined preferentially with the lower lips volume known to participate at the plump perception. The secondary parameters have been developed in order to highlight other phenomena related to plump effects.

Table 1: Volumetric parameters

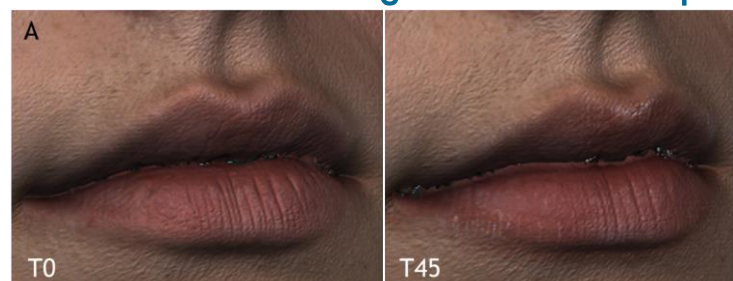
Primary parameters		
Global Volume (1)	Lower Lips Volume (5)	Upper Lips Volume (6)
Volume	Volume Height (2)* Length (2)**	Height (4)*** Length (2)**
Secondary parameters		
Lips Morphology (2)	CupidBow (3)	Philtrum (3)
Width Circularity	Height Width Angle	Amplitude Length (2)****



* Normal height and 3D height
** Lips 3D Length and Mid lip 3D length
*** Height, max Height, 3D Height and max 3D Height
**** Upper lips/Nose distance and 3D length

As shown in the Figure 1, a gain of 4.5% in the global lips volume was observed 45min after cosmetic treatment, from 3210±850 mm³ to 3355±802 mm³ (p<0.001).

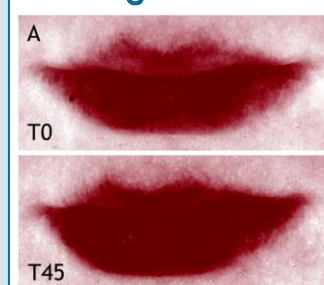
Figure 1: Increased lips volume



Additionally, we have quantified the vasodilator effect of the tested product by using the Microcirculation Index (Fig 2).

Results showed an increase of 5.2% of the response of the microcirculation to the Lip gloss from 0.368±0.016 a.u to 0.387±0.025 a.u (p<0.001).

Figure 2: Increased microcirculation



(1) Sol-Hui Song, Hye-Jo Min, Min Kyung Kim, Jeong-hee Kim, Lip Gloss Containing Punica granatum Flower Extract and its Volumizing Effect, Asian Journal of Beauty and Cosmetology, 10.20402/ajbc.2020.0018, 18, 2, (173-182), (2020).