RhinOnBlender

Rodrigo de Faria Valle DORNELLES[*1], Cícero André da Costa MORAES[2],
Juan Pablo Borges MARICEVITCH[3], Everton Luis Santos da ROSA[4]
[1] Department of Plastic Surgery, University of São Paulo, São Paulo, Brazil;
[2] Arc-Team, Cles, Italy;
[3] Hospital da Clínicas, Universidade Federal de Pernambuco, Recife, Brazil;
[4] Hospital de Base do Distrito Federal, Brasília, Brazil

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Abstract

Objective: The aim of this study is to develop an addon to Blender software, an accurate virtual planning protocol in rhinoplasty through three-dimensional (3D) technology and virtual tools using free software.

Methods: An addon to software Blender was developed with use a conventional photographic documentation to obtain a photogrammetry of patient. A virtual planning protocol was stablished to predict a rhinoplasty result, with the use measurements direct on the virtual mesh. After the process, a virtual guide was building with the possibilities to 3D printing to use in the surgery.

Results: Strong correlation between virtual planning with RhinOnBlender and the surgery results were observed. The 3D printing guide was usefull to orientate the surgeon during rhinoplasty surgery.

Conclusions: Protocol using 3D technology and virtual tools with an addon RhinOnBlender to a free software enabled precise planning to rhinoplasty surgery.

Keywords: three-dimensional image; face; plastic surgery; computer-aided image processing; photogrammetry; software.

1. Introduction

Rhinoplasty surgery is one of the most sought after procedures for plastic surgery patients, several are the complaints presented by patients seeking surgery. Ethnic characteristics, deviation of growth caused by respiratory pattern or by sequela of accidents, or demands for a better harmony of the nose in relation to the face, are the causes that motivate a procedure. During the anamnesis, the surgeon must be able to interpret the patient's explanations, while assessing the characteristics of the nasal anatomy, related to the aesthetic and functional aspects. The methods of preoperative evaluation of a rhinoplasty take into consideration from the anatomical aspects collected during the physical examination, to complementary examinations such as radiography, computed tomography or nasofibrobronchoscopy. These data should all be taken into account for planning the possible changes to be made in the surgery. The surgeon, taking into account subjective and objective data, based on previous exams, evaluates the possibilities of changes in the shape of the nose. To the point of creating an approach, strategy to achieve the objectives outlined in relation to the result. The planning with images allows, mainly to the doctor, to revisit the case several times and, with this, to make more probable the attainment of the desired results[1]–[6].

The virtual surgical planning programs are in accordance with these principles, since they allow for a great variation in the possibility of results, taking into account adequate anthropometric measures in relation to the patient's gender, ethnic origin and longing for results[7]. The 3-dimensional technology presents a profusion of possibilities with regard to commercial devices, both for capture and for data processing and extraction[8]. Commercial products vary in cost and often hamper or prevent the dissemination of the technique or the exchange of information. The possibility of using free software for the processing of these data in the medical field is still insipient, however it is in line with the worldwide trend in use of this tool, already established in several other areas. The objective of this study was to develop an addon for Blender software, with the possibility of creating a protocol for virtual rhinoplasty planning, using photogrammetry and modeling performed within the same environment.

* rodrigodornelles@gmail.com; +55 11 981222432, www.rodrigodornelles.com

2. Method

It was developed in python language, by one of the authors, with expertise in facial reconstruction using Blender, an addon called RhinOnBlender, to run in Blender software. The authors used the tool in 15 patients, performing photogrammetry; virtual modeling, anthropometric measurements and STL file preparation for splint printing for surgery. Surgeries were performed according to the usual technique of each surgeon, with the use of splint for intraoperative parameter of virtual planning.

3. Test/Data

The site for free addon installation can be found and downloaded via the https://github.com/cogitas3d/RhinOnBlender link (Figure 1). The installation offered is multiplatform, that is, in Linux, Mac and Windows language. It was easy and quick installation with dedicated tutorial. Information and tutorials for 2D photographs are provided on the site for photogrammetry by the tool.

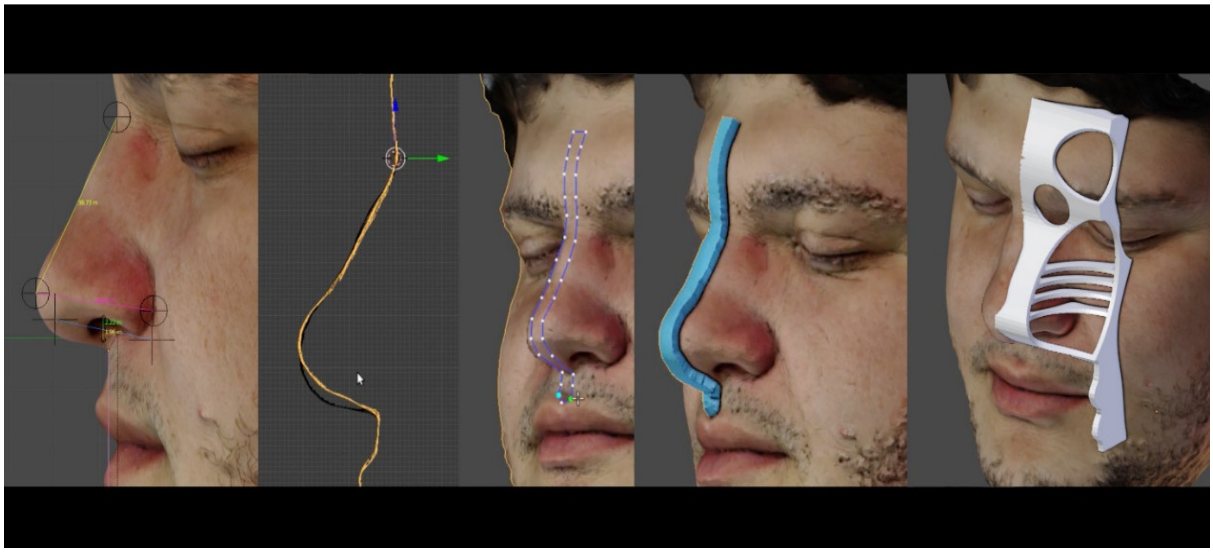

Fig. 1. - Image of the site of the intraoperative splint elaboration phases for rhinoplasty.

Each patient was attended by the surgeon, having been made anamnesis, physical examination and routine supplement for each case. The sequences of photographs were taken and imported by the addon. Once the 3D mesh of the patient was obtained, the system presented chronology in the commands so that the user could obtain the preoperative measurements of the nasal region. After the mesh modeling modifications were performed in the nasal region, such as nasal dorsal reduction, nostril narrowing and tip projection, according to the surgical experience of each surgeon in the study. With visualization of the desired result, an intraoperative splint was generated in STL file ready for printing.

Each patient underwent surgery using intraoperative splint to adjust and adjust according to each previous planning performed in RhinOnBlender.

4. Results

The construction of a three-dimensional image from 2D photographs proved to be effective with the follow-up of the specific tutorial. The accuracy of the measurements of the photogrammetry was observed with the use of the calibration tools of the addon (Figure 2-3). The virtual modeling made through the available tools was easy to manipulate, allowing the evaluation in more than one scenario, being able to choose the most appropriate for each case. The use of the measurement and linear template of the nasal pyramid was intuitive, contributing to the observation of the linear, angular and projection of the nasal pyramid. The nasal splint printed in 3D can be manufactured by 3D printer from the direct export of the file that had already been prepared by the addon and was used in each case to serve as parameter to the surgeon.

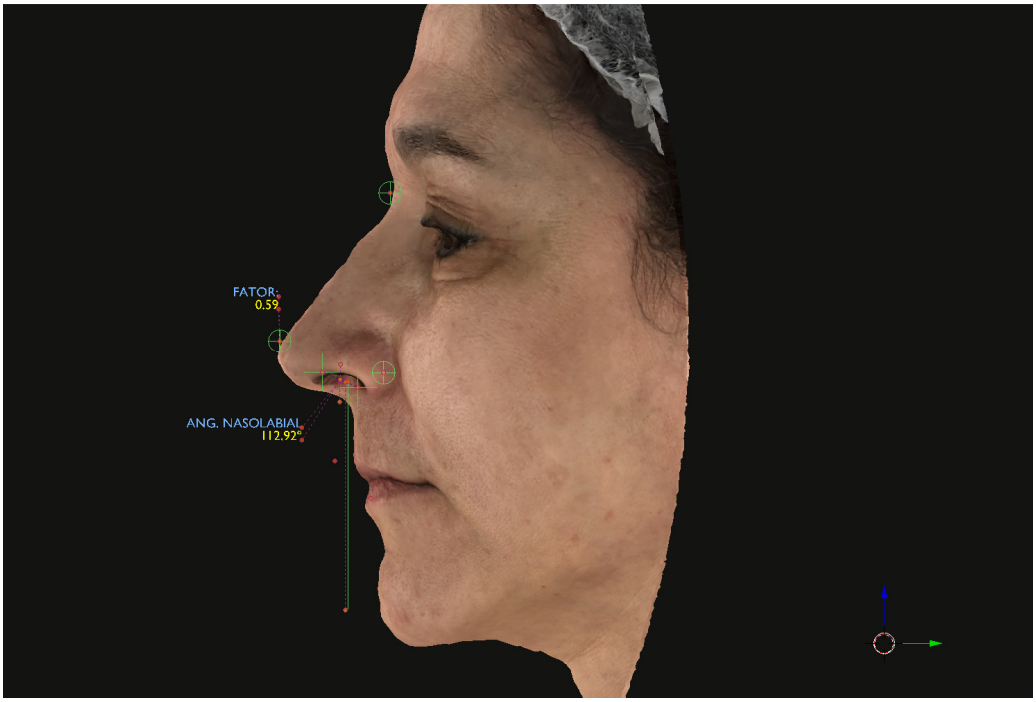

Fig. 2. - 3D View screen capture of RhinOnBlender showing the right profile in the preoperative rhinoplasty evidencing the anthropometric measurements of the nose

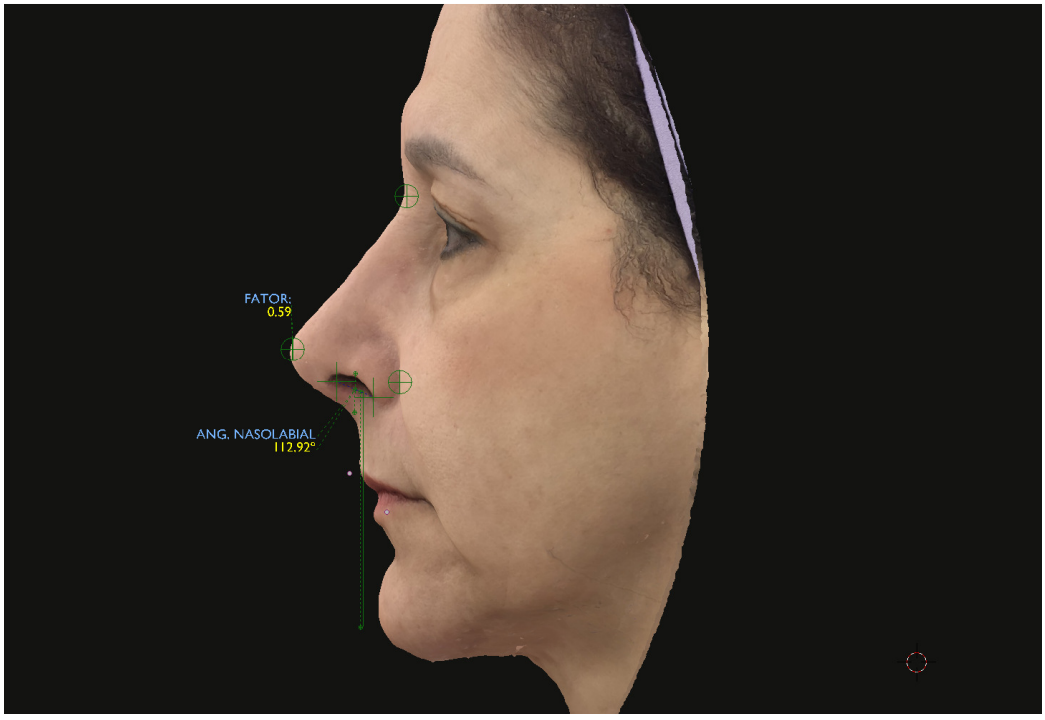

Fig. 3. - 3D View screen capture of the RhinOnBlender effi cient the right profile in the postoperative rhinoplasty evidencing the anthropometric measurements of the nose

5. Conclusions

Intraoperative splint was useful in the tangible observation of the target nasal profile, having, together with the abstract experience of the surgeon, contributed to the accomplishment of the planned modifications.

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