Innovation

Smile Analyzer: A Software Package for Analyzing the Characteristics of the Speech and Smile

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Abstract

Taking into account the factors related to lip-tooth relationships in orthodontic diagnosis and treatment planning is of prime importance. Manual quantitative analysis of facial parameters on photographs during smile and speech is a difficult and time-consuming job. Since there is no comprehensive and user-friendly software package, we developed a software program called "Smile Analyzer" in the Department of Orthodontics of Mashhad Faculty of Dentistry for measuring the parameters related to lip-tooth relationships and other facial landmarks on the photographs taken during various facial expressions. The software was designed using visual basic. NET and the ADO. NET was used for developing its Microsoft Access database. The program runs on Microsoft Windows. It is capable of analyzing many parameters or variables in many patients' photographs, although 19 more common variables are previously defined as a default list of variables. When all variables are measured or calculated, a report can be generated and saved in either PDF or MS Excel format. Data are readily transferable to statistical software like SPSS for Windows.

Key Words: Smile, smile analyzer, software, speech.

Introduction

The goal of modern orthodontics is to improve the quality of life (1) which, at least in part, is achieved through the enhancement of the patients' smile and facial appearance (2). Orthodontic diagnosis and treatment should carefully consider the patient's facial appearance and esthetics (3). In case of sacrificing esthetics for the sake of good occlusion, the patient will not be satisfied with the treatment outcome, even if all the functional goals have been achieved. Improvement in facial esthetics is a powerful motivation for seeking treatment (4,5). Thus, it is of prime importance to take into account the factors related to lip-tooth relationships in orthodontic diagnosis and treatment planning (6-8).

To reach this goal, the orthodontist should be able to measure the parameters related to lip-tooth relationships. However, manual quantitative analysis of facial parameters on photographs during smile and speech is a difficult and time-consuming job, especially when digital photographs are used and data are stored in a digital database. Ackerman et al. (9) have previously introduced the Smile Mesh to analyze photographs of posed smiles. Although useful, the Smile Mesh can only measure 11 attributes of a smile. Moreover, to our knowledge, it solely is compatible with the Apple-Macintosh operating system not the Microsoft Windows. Since there is no comprehensive and user-friendly software package, we developed a software program for analyzing the parameters related to lip-tooth relationships and other facial landmarks on the photographs taken during various facial expressions.

Method

The "Smile Analyzer" software was designed using VisualBasic.NET and the ADO.NET was used for developing its Microsoft Access database. The "Smile Analyzer" runs on Microsoft Windows. The program can also be improved so that the database is accessible over a network.

This program is capable of analyzing many parameters or variables in many patients' photographs, although 19 more common variables are previously defined as a default list of variables.

As each operator will have his/her own database to work with, each user should first define a username and a password (although the administrator has access to all databases). After signing in, the first step is to define patients by entering the characteristics of each one (Fig. 1). Then, as many as desired images can be assigned to each patient (Fig. 2). The next step is to specify which parameters will be measured on each image. This is done by either adding the default list of 19 variables to each image or defining new variables (Fig. 3). An interesting feature of the software is that many lists each containing of desired variables can be generated so that a whole list will be added to each image and there will be no need to add variables one by one.
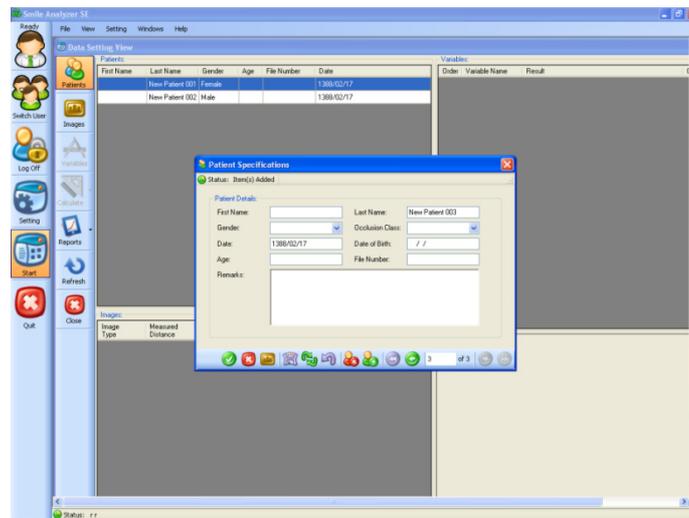

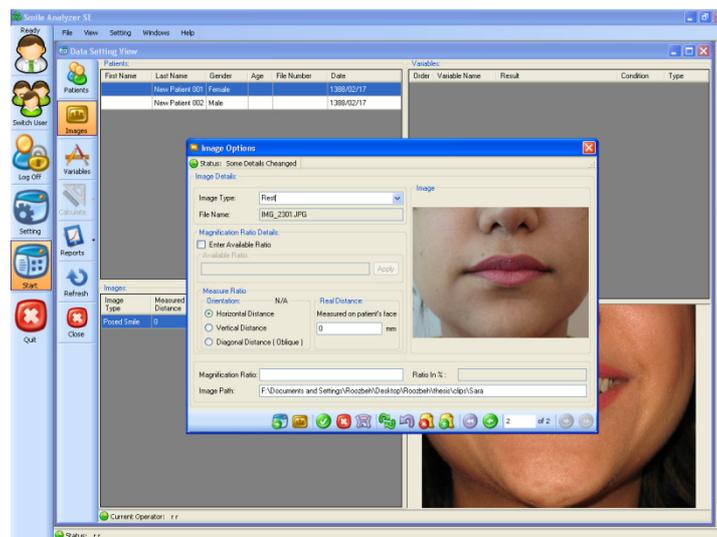**Figure 1.** Entering the characteristics of patients

Figure 2. Assigning images to each patient

Supposing that patients, images and variables are defined, the next step is to enter the measuring environment. For each image, first, the magnification ratio is set. Then, the variables are measured (Fig. 4). If a variable is not measurable but calculable (e.g. the smile index), the arithmetic formula to calculate it can easily be defined.

When all variables are measured or calculated, a report can be generated and saved in either PDF or MS Excel format (Figs. 5,6). Data are readily transferable to statistical software like SPSS for Windows. The whole database can be backed up using the export option.

This software is useful for measuring purposes on all digital images in any format. Thus, the "Smile Analyzer" is a useful tool for conducting studies in which measuring is needed (10). In fact the application of "Smile Analyzer" is more than just analyzing lip-tooth relations on frontal facial photographs as we measured cephalometric parameters on digital lateral cephalograms by means of this software (11).
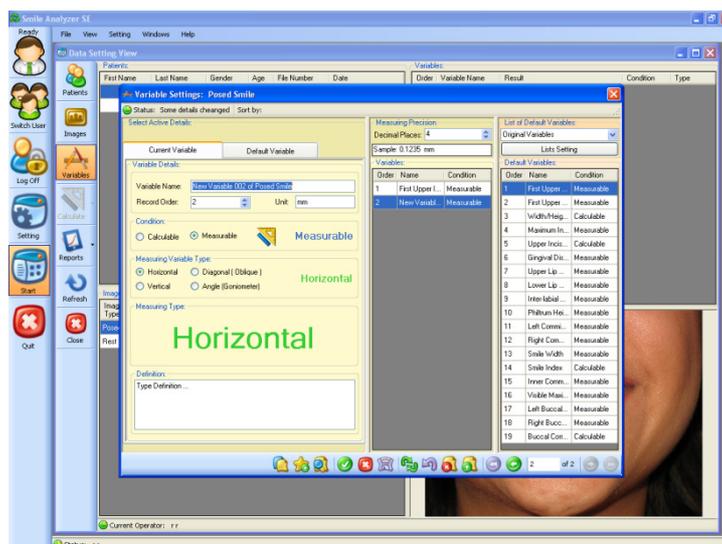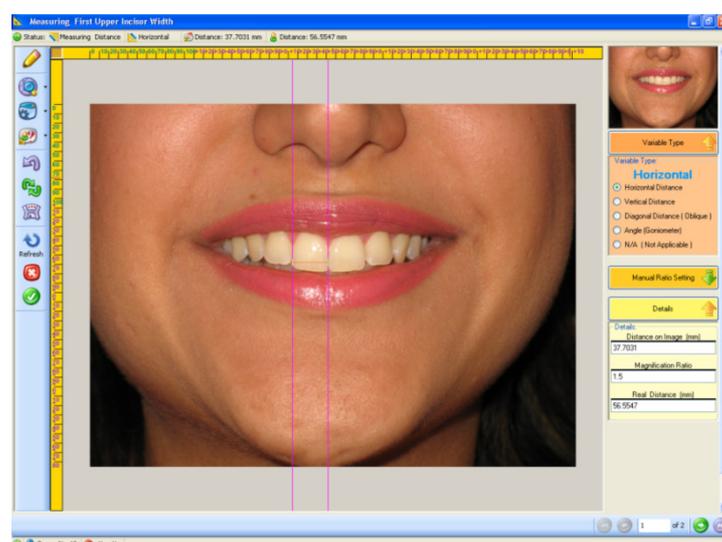

Figure 3. Defining variables to be measured

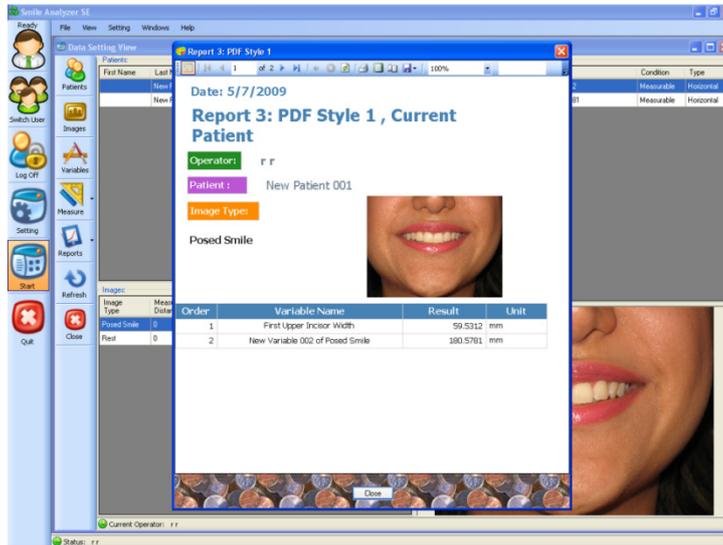**Figure 4.** Measuring a variable (here, the upper central incisor width)

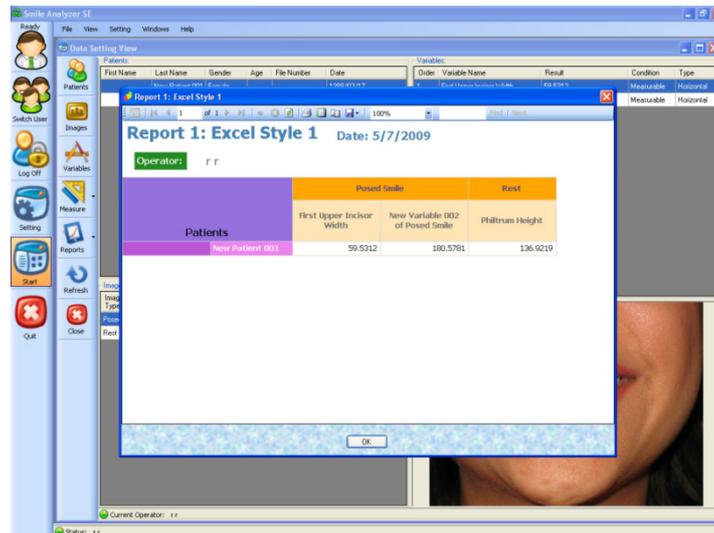**Figure 5.** Smile Analyzer report in PDF format

Figure 6. Smile Analyzer report in MS Excel format

"Smile Analyzer" was designed in the Department of Orthodontics of Mashhad Faculty of Dentistry by the authors and it is Patent Pending No. 10/615 from Information Technology and Digital Media Development Center, Ministry of Culture and Islamic Guidance.

During developing and utilizing the software, the designers eliminated the drawbacks and repeatedly checked the accuracy of measurements. In preliminary studies in which "Smile Analyzer" was used, reasonable results were achieved. However, it is recommended to compare its accuracy and reproducibility with other measuring methods.

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