



Application of a 3D scanner in medicine - scan3D med

Subject: Calculating the surface of skin lesions using a 3D scanner scan3D med from SMARTTECH together with software SMARTTECH3Dmeasure. Based on samples provided by the clinic SMILE AND BEAUTY

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1.Introduction

The SMARTTECH scan3D med is used in the medical aesthetic clinic Smile & Beauty. The clinic specialises in, among other things, the production of its own skin creams. One of the many applications of the skin creams is the treatment of skin lesions, such as scars, discolorations, pimples, or keloids. It is the treatment process of the last one mentioned that is going to be discussed in this report. The keloids, also known as keloidal scars, occur as a result of even mild skin wounds, such as common acne, a scratch, piercing or a burn. Because of too much collagen, the wound doesn't heal properly and instead the scarswells and overgrows, changing the shape of the skin.



Fig. 1 Keloids on the chest caused by the scarring process after acne.

People affected by this condition rarely undergo the surgical removal of the scar due to high risk (greater than 50% of cases) of reoccurrence. That is why one of the main methods of treating keloids is the use of ointments with salicylic acid or silicone gels.

The clinic Smile & Beauty, located in Warsaw, uses the 3D scanner scan3D med to accurately measure the effectiveness of its preparations.

In this report we will discuss how, by using a 3D scanner, you can effectively examine the healing process of skin lesions (keloids) and you will learn how you can quickly and very accurately examine the surface of skin lesions during the experimental cream testing.

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2. The 3D scanning process – obtaining the geometry and colour of skin lesions

The 3D scanning takes place in the room of the medical aesthetics specialist thanks to the use of structured-light as a measuring method. This method of measurement is not only fast but also completely safe and non-invasive. It is not necessary for the operator to leave the room as is the case during x-rays. The patient can comfortably lie on the bed under the measuring head that is set on a tripod or can stand directly in front of the doctor.

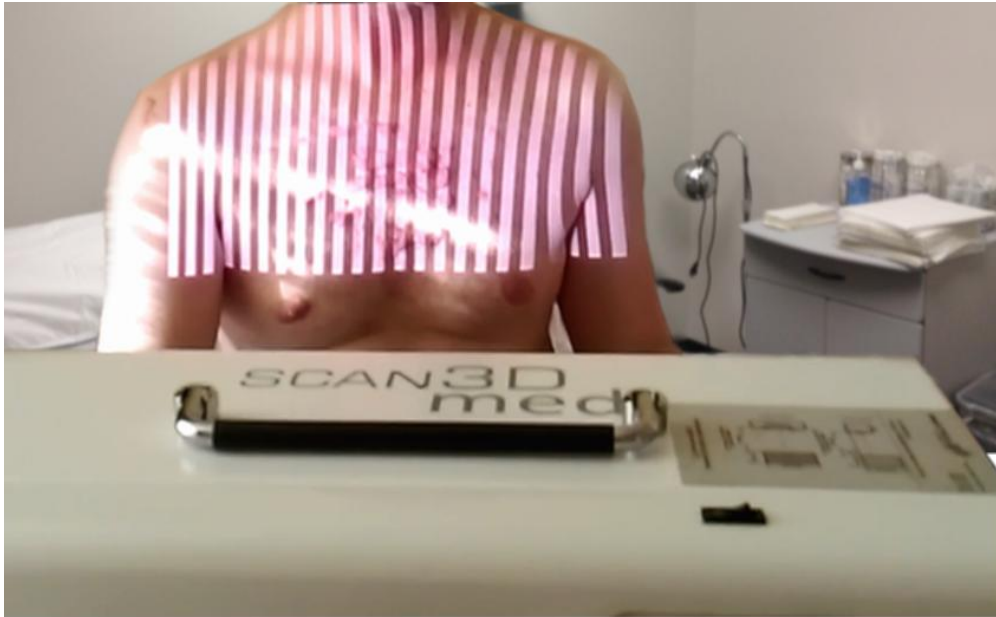


Fig. 2 3D scanning of the patient's skin.

The 3D scanner used by Smile & Beauty is permanently calibrated at a 400x300x300 mm measuring volume which is sufficient for the surface measurement of chest skin. By having a permanently calibrated measuring volume the scanner works with a specified accuracy (in this case, 0,04 mm) and is ready to work immediately after turning on, without the need for calibration. As a result the 3D scanner can be used without any metrological knowledge and, even more importantly, it can make measurements of a far greater number of patients during the time of its operation.

The 3D scan is performed in under one second. The technology is based on projecting a pattern of light (fringes) on the object and analysing the deformation of the pattern on that object registered by the detector.

Then, using mathematical algorithms to convert the data collected from the scans, the computer screen displays the result in the form of a colour point cloud representing the scanned surface. The 3D scanner, equipped in 1,3 MPix, provides 1 300 000 points that precisely describe the shape and colour of the scanned surface.

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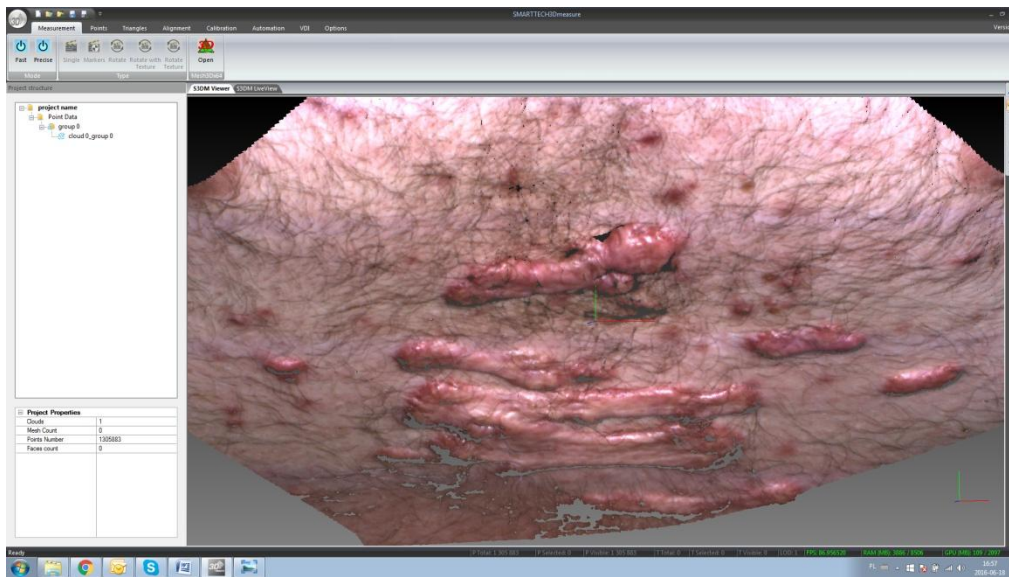


Fig. 3 The point cloud representing the scanned surfaces of the chest – 3D scanning result.

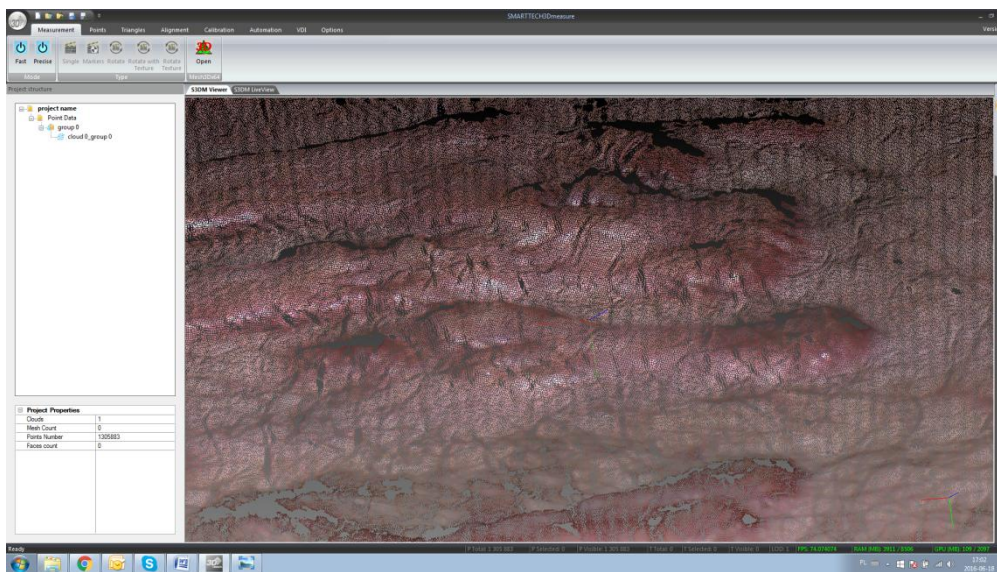


Fig. 4 Close-up on the point cloud – showing each point described by the coordinates X, Y, Z and RGB colour values.



3. Work in SMARTTECH3Dmeasure

The scanning head, in addition to the transportation case, the tripod and wiring, is also provided with the SMARTTECH software together with a dedicated computer assuring a comprehensive solution for the digitalization of patients.

The software SMARTTECH3Dmeasure allows us not only to operate the scanning head but also to analyse the data obtained by the scanner.

In order to accurately calculate the surface of skin lesions we have to extract them from the rest of the healthy surface that was obtained. You can do this in two ways:

- using an algorithm that differentiates the colour of points – in this case the area closest to red.
- or
- manually selecting the desired points using the available options of selection (brush, circle, polygon or lasso)

Since the scanned area contains pimples that have the same colour as the keloids – the better method is the manual selection.

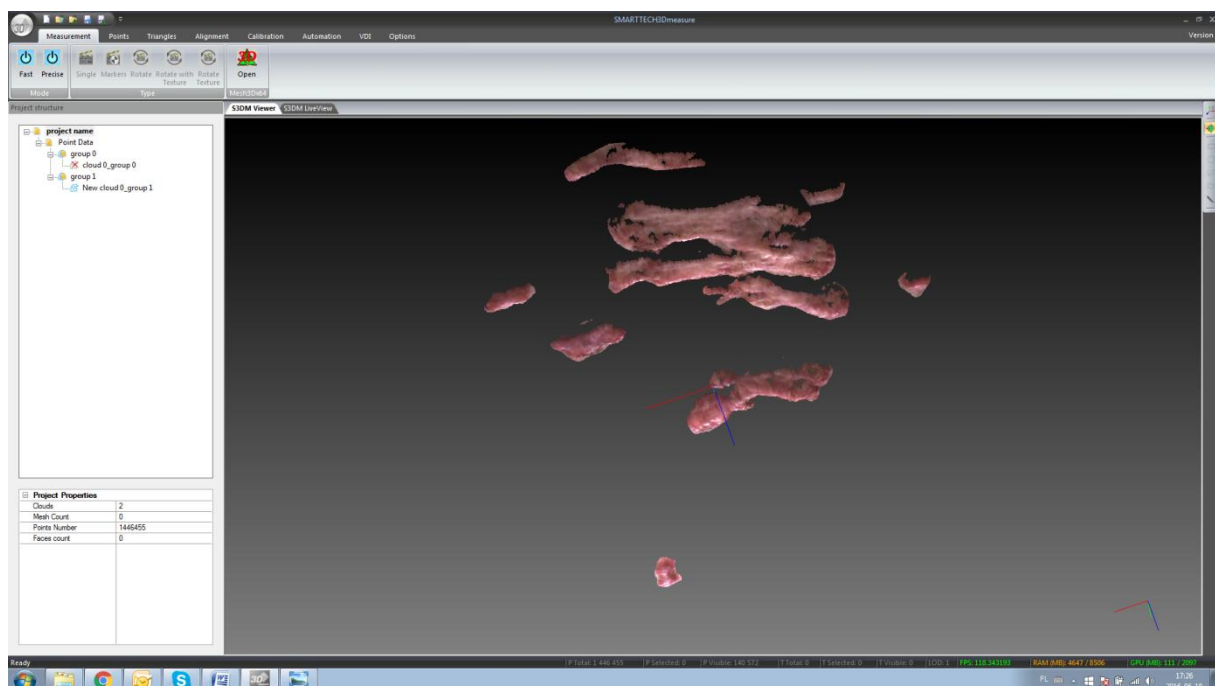


Fig. 5 The scanned surface of keloids extracted from the scan.

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The manual selection of the areas takes about 5 minutes in this case.

After choosing the desired area we have to create a new cloud of points representing only the selected area and then convert it to a triangle mesh.

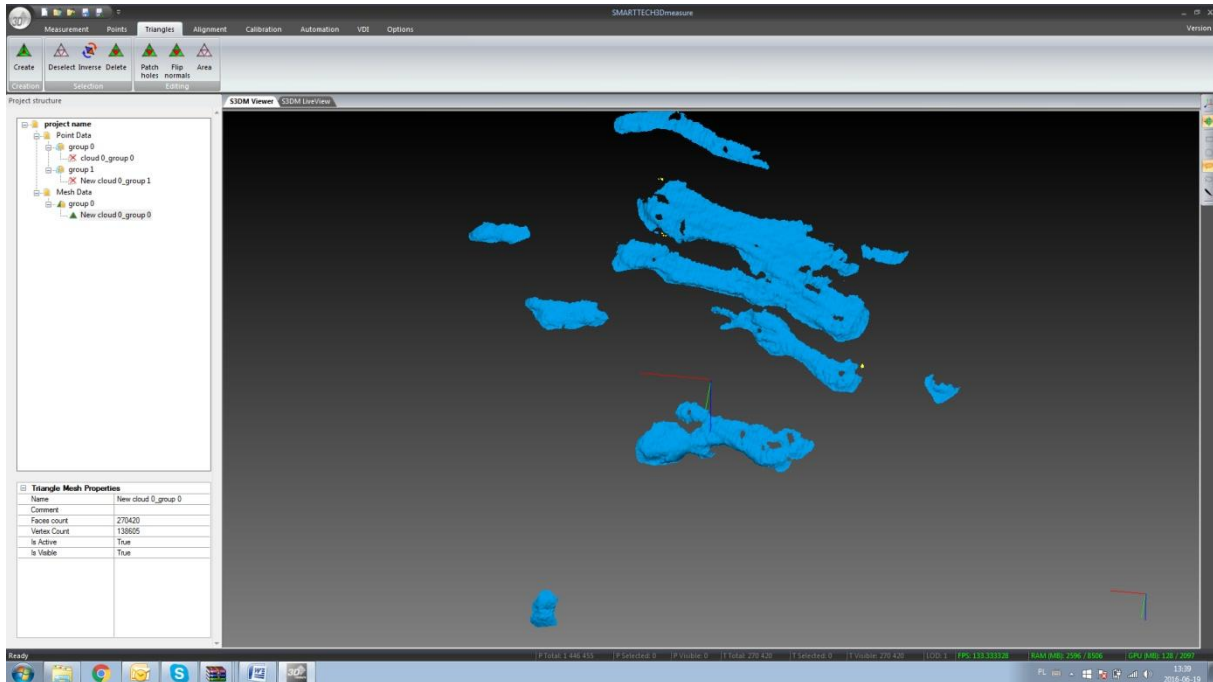


Fig 6. The triangle mesh from the selected point cloud.

Once we have the triangle mesh we can very easily calculate the exact surface by selecting the whole or part of the mesh and clicking the “area” in the tab *triangles*.

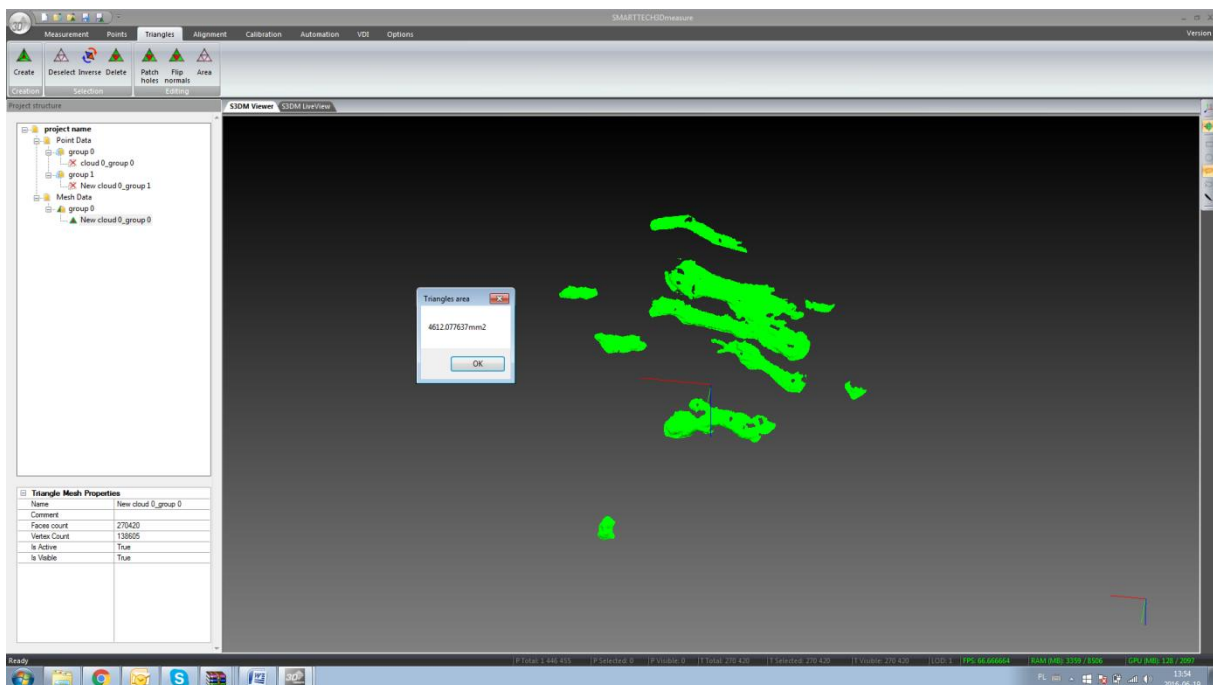


Fig. 7 The selected surface of the triangle mesh and its automatically calculated value.

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With these few simple operations we are able to very accurately determine the value of the surface that is of interest to us. The keloids on this patient's skin take up over 46,1 cm².

The scanning will be repeated after 2 months during which the patient will undertake an experimental ointments treatment that is based on medical grade silicone.

4. Conclusion

The measurement of the skin surface of the patient using a 3D scanner is a very accurate method providing that important comfort to the patient who spends only a moment (with the scan taking under a second) for a very precise analysis. The contact-less measurement using the LED structured light is completely painless and entirely safe. It doesn't require any additional activity from the patient or the doctor. The process is based solely on projecting white light on the patient's skin and the entire analysis is conducted on a virtual model that accurately represents the scanned area.

The cloud of points obtained from the scanning process in under one second contains all the information about the shape and colour of the examined area which allows for a very detailed examination of the patient without his constant presence.

The software SMARTTECH3Dmeasure provided with the 3D scanner allows for the transformation of the cloud of points into a triangle mesh and automatic calculation of its surface. It enables a very careful monitoring of the process occurring on the skin, both in terms of shape as well as colour. All of these characteristics make it one of the best solutions for digitization of live organisms available on the market.

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