UNITIKA
We Realize It!

3D measurement of the human body

This case study presents a research on the measurement of the human body. The aim is to show the impact of textile products and differences between the used materials on the size of the legs swelling.

Contents

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1. Introduction

The company UNITIKA GARMENTS TECHNOLOGY, LTS is a research agency that meets ISO / IEC17025 standards. We conduct activities in the field of dimensional inspection and quality control of textile and plastic products. Thanks to many years of experience and enrichment of our research methodology, we are able to provide a reliable reports that will not only improve comfort, but also optimize production costs. Using the latest analytical and measurement methods, we follow the latest trends in the clothing and textile industry by proving the changes that take place in the body in contact with various materials. Our latest acquisition is a metrologically certified SMARTTECH 3D scanner that allows dimensioning of the human body.

(Our main work) – textile product quality performance, measurement assessment

– measurement assessment of safety and hygiene functions,
– chemical analysis, optical / electron micrography,
– assessment of comfort and functionality,
– human physiology measurement.

2. Problem

In the case of the dimensioning of human physiology, it is sometimes necessary to measure a person and make calculations related to the body. An example here is the dimensioning of the human face and after treatment or waist before and after wearing the belt. Among such works there also the dimensioning of legs swelling in order to verify the influence of the compression sock on the body.

Originally, using traditional measurement methods, we asked volunteers to try not to wear socks all day to measure the natural level of legs swelling. The test was then repeated – this time with the compression sock. By taking the measurement in the morning and in the evening, we measured the volume of the legs using a container with water to calculate the volume based on the filling.

It quickly turned out that it was extremely difficult to make calculations in this way, because the legs swelling is too small for accurate measurement. Among the encountered problem, we should also mention modifications of the assessed functionality of a textile product in the course of the

study, which in many cases made the area immeasurable by using traditional measuring methods.

For this reason, the study of the level of legs swelling required a different metrology system than the one we used so far We needed a precise device capable of performing accurate measurements together with the possibility of making a comparison between the influence of individual textile products on the legs swelling a particular measuring point.

3. Measurement and legs swelling assessment

For measurement, we decided to use an optical 3D scanner operating in structural light technology. The device is not only extraordinary accurate, but also completely safe for the skin. Purchased SMARTTECH optical measuring system allows us to obtain precise data in color by projecting stripes of light on the measured object. In addition, the device instantly detects our markers, thus meeting expectations regarding the determination of the measuring point.

In addition, the scan3Dmed system thanks to a large volume of 800 x 60 x 350 mm allows us to measure not only the legs, but also the arms and chest. Due to the short measurement time (0.7 seconds) we are able to minimize the impact of the respiratory system. We also managed to automate the measurement thanks to the SMARTTECH3Dmeasure software and a dedicated rotary stage.

Fig. 1. 3D scanning using a rotary stage.

4. Data processing

The SMARTTECH3Dmeasure software, added to the 3D scanner, is sufficient to carry out all research tasks. Thanks the volume measurement functionality, we collected all the necessary data and then presented it to the customer in the form of generated report.

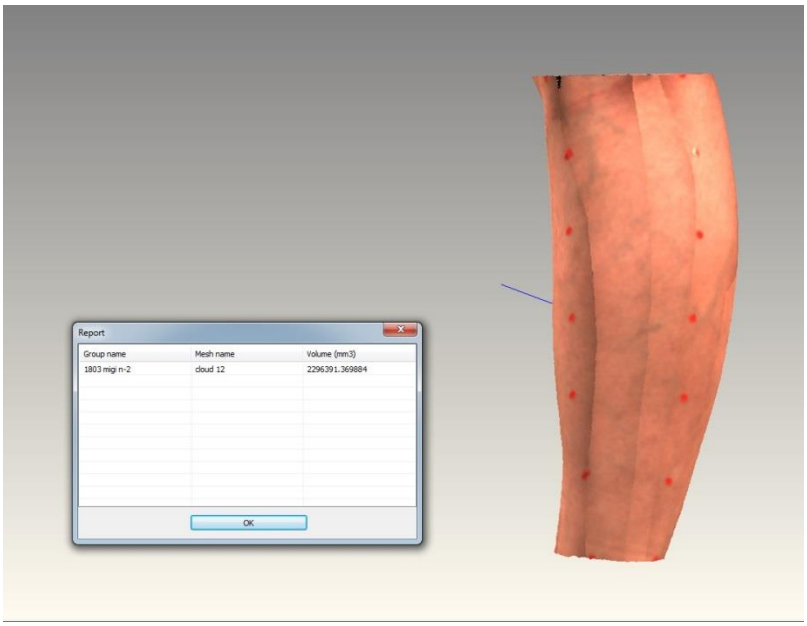
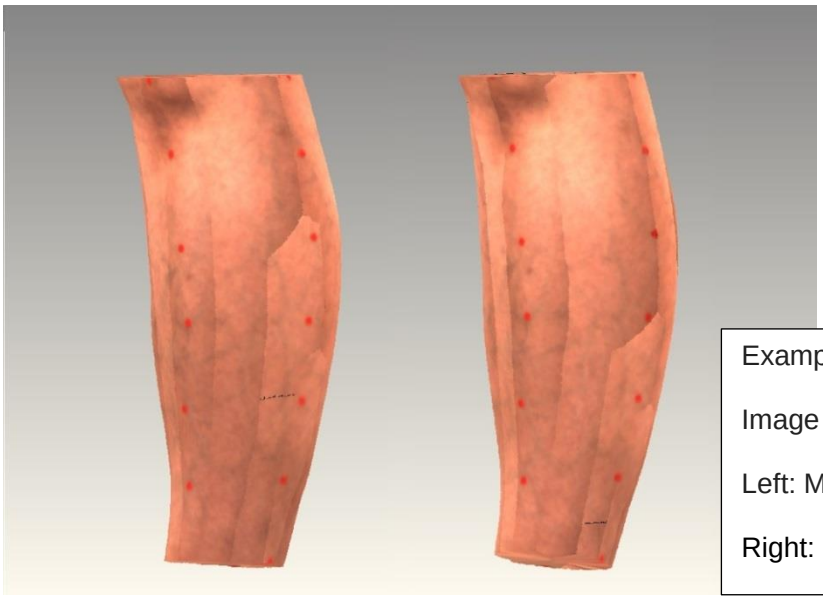


Fig. 2. Volume measurement by S3DM.



Example:

Image data of the calves

Left: Morning (No swelling)

Right: Evening (Swollen)

Fig. 3. Calf measurement image of morning and evening.

Volume capacity measurement of foot (calves) Target: 4 people

Sample	Volume(cm3)			Rate of change (%)
	Morning(10:00)	Evening (16:00)	Change amount	
Socks Type A	2445	2391	**-54**	**-2.2**
Socks Type B	2364	2358	**-6**	**-0.3**
No socks	2442	2490	**48**	**2.0**

Table 1. Volume measurement result table

The results provided us with all the necessary data. As the Table 1 shows, the daily natural volunteer's leg swelling increases its volume by 2%, only to return to its original state from 10:00 am. The type B sock kept the volume of legs swelling from 10:00 am whereas type A reduced it by 2% compared to the original condition.

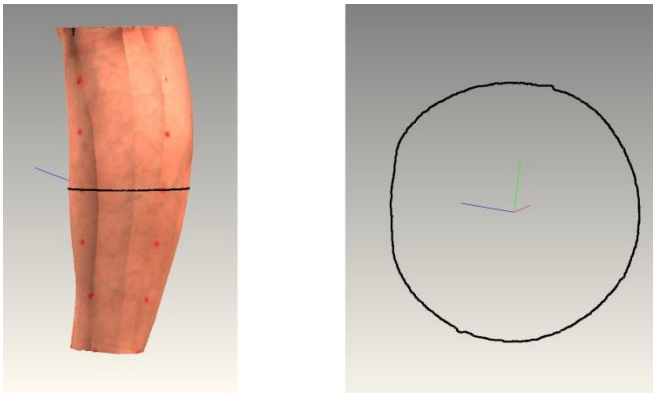


Fig. 4. Leg radius data.

In addition, as shown in Figure 4, software added to the optical 3D scanner allowed us to count the diameter of the perimeter of the leg at rest for further investigation.

5. Conclusion

The analysis not only made it possible to evaluate the effectiveness of the client's textile products, but also provided a lot of additional data. In addition, thanks to the ability to store 3D models, we are able to conduct further tests without re-engaging volunteers, thus reducing costs and time needed.