Plastinated Tissue Evaluation by Optical Coherence Tomography

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Examination of skin affected by various pathological conditions is very difficult to perform using standard methods in the field of dermatology. In this study, human skin taken from bodies preserved in formalin 10% was dehydrated with acetone 100% by freeze substitution, and then plastinated with S 10 technique. After plastination, the specimen of skin was analyzed using optical coherence tomography (OCT).

Keywords: plastination, Optical Coherence Tomography, Non Invasive Investigation

Plastination is a method of tissue preservation in which biological specimens are impregnated with a curable polymer by using the variance in vapour pressure between the infiltrating polymer on the one hand and acetone or another solvent on the other hand, in order to promote tissue impregnation. In the process of plastination, water and lipids in the original tissue are replaced by the curable polymer which is subsequently hardened, resulting in dry, odorless, and -most important- durable and non-hazardous specimens [1, 2]. In the recent years, the use of plastination has gained an increasing importance in the medical and educational practice, due to its many advantages; the procedure goals imply:

-long time preservation of bodies, tissues or whole organs with the intent of making them suitable for medical demonstrations and various scientific applications, making recurrent use of solutions or other methods of tissue preservation needless, as the resulted specimens are maintenance-free and do not deteriorate with time [3];

- creating libraries of non-toxic, long-resistant and inodorous specimens readily available and easily accesible for educational and/or scientific purposes, consistent with the changing trends in modern medical training;

- optimising the use of human anatomic specimens that are in shortage for teaching or scientific purposes;

- demonstrating the benefits of preservation with true plastination of body/organs/tissues for medical education. The method offers multiple advantages: *inter alia*, it renders the examination of the studied specimens safer, it eliminates the requirement of wearing gloves and provides the possibility of immediate observation of the specimen without being restrained to seeing through glass plates interposed between the examiner's eye and the specimen;

- eliminating the disadvantage of using formaldehyde, improving safety for both the staff and the students by making manipulation of formalin preserved specimens no longer mandatory in medical training;

- using the sections processed by plastination for subjects to various imagistic explorations such as computerised axial tomography (CAT) scans, magnetic resonance imaging (MRI) and sonographic techniques that can offer a new three dimensional perspective on normal human anatomy and its variations [2, 8, 9].

Six specimens of human skin were taken from bodies , fixed previously in formalin solution of 10%, dehydrated and degreased with acetone and then plastinated with Biodur S 10.

The role of plastination in OCT examination is very high, because all tissues being solidified the fluids do not influence the analyze, appearing less and less artifacts. Without plastination, formalin and other body fluids may be able to influence the results.

Experimental part

Materials and methods

All skin specimens are taken from six different regions of human body: upper and lower limbs, thorax, abdomen, head and neck. The bodies were previously injected with a formaldehyde solution 10%. Dimensions of specimens are 2-3 cm^2.

Skin specimens were dehydrated in acetone bath, by freeze substitution at -25°C, and degreased at room temperature. Four solutions of acetone are employed because the skin, with its three major components epidermis, dermis and hypodermis, contains water and adipose tissue.

After dehydration and degreasing, the specimens are immersed in a mixture of Biodur S10-S3 and subject to a vacuum pump. Acetone is evacuated from the tissues and replaced by silicone. In the ending step of plastination, the specimens are cured by a gas hardener called Biodur S 6.

The results of plastination consist in a good method of preservation of all tissues and the possibility to be analyzed by optical coherence tomography.

The evaluation imply a 1300 nm Time Domain Optical Coherence Tomography system.

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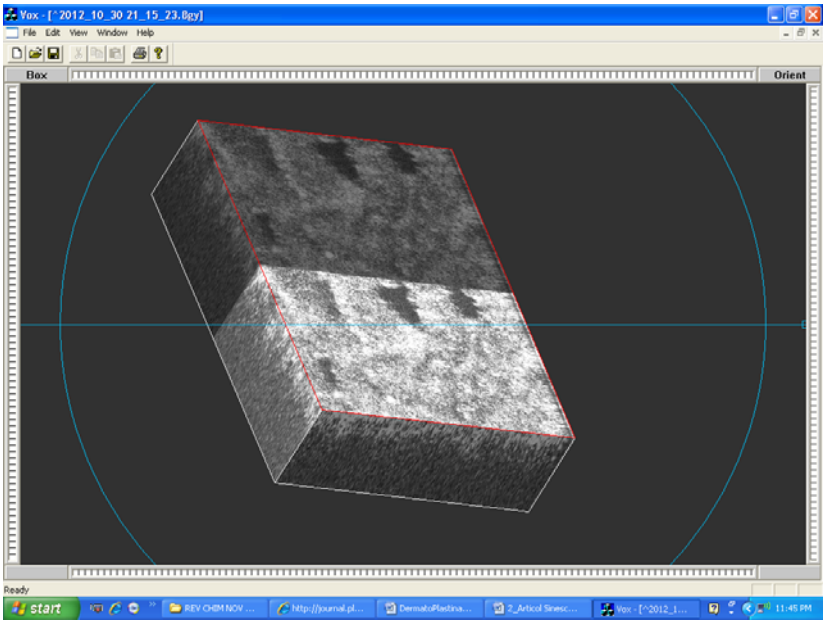

Fig.1. 3D reconstruction of the plastinated finger

Results and discussions

After the noninvasive investigation using optical coherence tomography 2D 98 slices were obtained. A 3D reconstruction was obtained on them (fig.1.).

Conclusions

In conclusion, the optical coherence tomography combined with plastination technique could be used for a better evaluation of the skin.

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