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PHOTOELASTICIMETRY METHOD USED TO HIGHLIGHT DEFORMATIONS OF THE LEFT DELTOID OF THE HUMAN BODY. MODEL CREATION

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Abstract: *In a grouping of two papers is presented how photoelasticimetry is used as a method of qualitative analysis, which offers the possibility of visualizing the deformations that occur in the material depending on the request of the parts made during the experiments. In this first part, we present the creation of models of the left deltoid muscle of the human body.*
Keywords*: photoelasticimetry, left deltoid muscle, creation of models*

1. PHOTOELASTICIMETRY PRINCIPLE

Photoelasticimetry is an experimental method by which we can determine the distribution of states of tension in bodies. The method is based on the birefringence property of an isotropic and transparent material when it is mechanically stressed by external forces. In the case of photoelasticimetry we can directly detect the tension states that occur in the entire mass of the body / part studied and not just mechanical deformations. By this method, bodies with more complicated construction geometry can also be studied. In his paper will be use the photoelasticimetry by transparency [Bot_11].

2. CREATING A MODEL OF A HUMAN SUBJECT

The experimental model created for the application of the photoelasticimetry method is dimensionally realized according to the left deltoid of the human subject investigated by the Bowen technique. This is emphasized in the paper [Ghe_21a].

From the two sized subjects, the subject no. 1 is chosen, considered healthy in terms of left deltoid demands.

2.1. Bowen's technique applied to the left deltoid.

In this paper, the tension states in the muscle mass of the left deltoid analyzed in the study are highlighted. The state of tension and how it is distributed in the deltoid muscle mass can be evidenced by the phenomenon of birefringence, when a model of the left deltoid muscle is statically stressed specifically to the shoulder procedure in the Bowen technique.

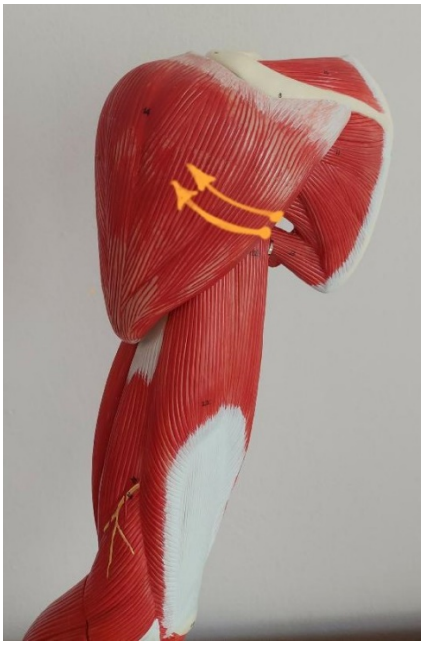

Fig. 1. Posterior deltoid strain (Movement 1 of the Bowen shoulder procedure)

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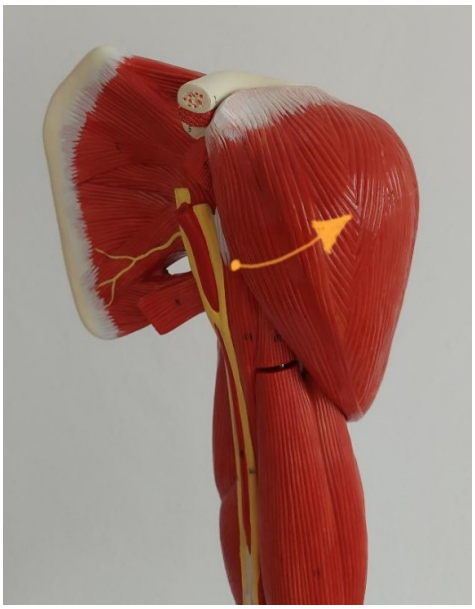

Fig. 2. Anterior deltoid strain (Movement 3 of the Bowen shoulder procedure)

These are two stresses, the first performed on the edge of the muscle fibers of the posterior deltoid with two fingers (of the Bowen operator) perpendicular to the middle of the muscle fibers of the posterior deltoid (Fig. 1), and the second static stress is performed over the anterior deltoid muscle (with operator fingers) perpendicularly and in the middle of the anterior muscle fiber of the left anterior deltoid (Fig. 2).

2.2. Model purchase

For this, a left arm model of subject 1's arm size was purchased, the subject healthy, controlling [Ghe_21a]. After the deltoid muscle corresponding to this arm model, two epoxy resin models will be made.

Models will be requested according to the Bowen shoulder procedure. For one model the request will address the left posterior deltoid, and for the second model the static stress will be achieved by applying a force on the marginal muscle fibers of the anterior deltoid.

The left arm of the purchased model is shown in figure 3 [Irs_15].

Fig. 3. Left arm purchased for modelling [Net 23]

The volume of the deltoid muscle model is 528 cm^3, larger than that of S1 by 24 cm^3.

3. EXPERIMENTAL ACTIVITY FOR THE HUMAN LEFT DELTOID

In order to study the tension states in the left deltoid muscle, we had to make, according to a model of the deltoid muscle, a model of an optically active material (epoxy resin EP 14NV) to facilitate, following its section, the highlighting of the propagation of voltage states in the material.

3.1. Stages in making the model of the investigated human subject

For this, the following steps were undertaken:

1. Acquisition of a left arm model that is close in size to the reference subject in the study, S1 healthy female subject (Fig. 3). Arm model allowing detachment of deltoid muscle to replicate and study (Fig. 4).

Fig. 4. Left deltoid detached from arm

2. Purchase of silicone rubber for mold and epoxy resin for molding of replicated left deltoid pattern. Purchased / used two-component silicone rubber DY-A420 (Fig. 5).

Fig. 5. Materials purchased for the realization of the left deltoid model

3. Manufacture of a silicone rubber mold DY-A420 for the left deltoid muscle (Fig. 6b) and a mould for the control disc (reference which will not be required from the active optical material (Fig. 6a) – the same resin used for casting the final mould).

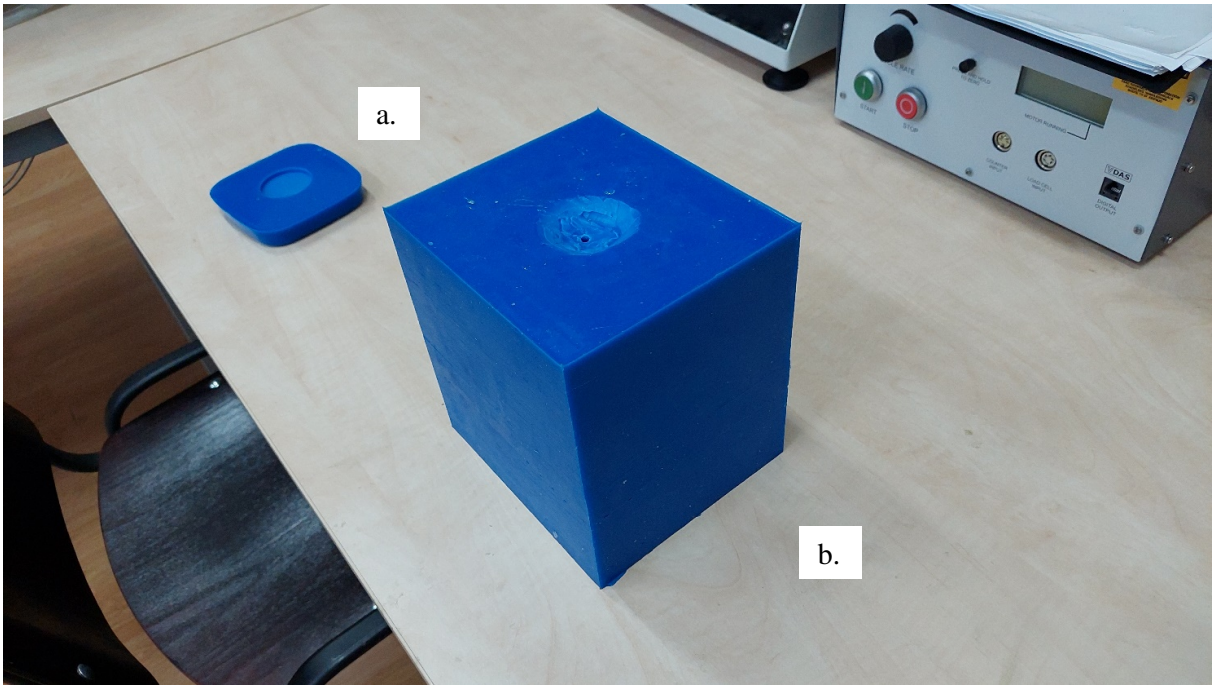

Fig. 6. Moulds for: a. Control disk; b. Left deltoid

4. Casting EP 14NV epoxy resin into mold for left deltoid muscle replication. There were cast 2 models for requesting the posterior and anterior deltoid respectively

(Fig 7b.) and 2 control discs that will be unstressed (Fig. 7c) for checking the isotropic environment.

Figure 7 contains the open mold (Fig. 7a), to which are added the two cast patterns of the left deltoid, together with the two discs of deference.

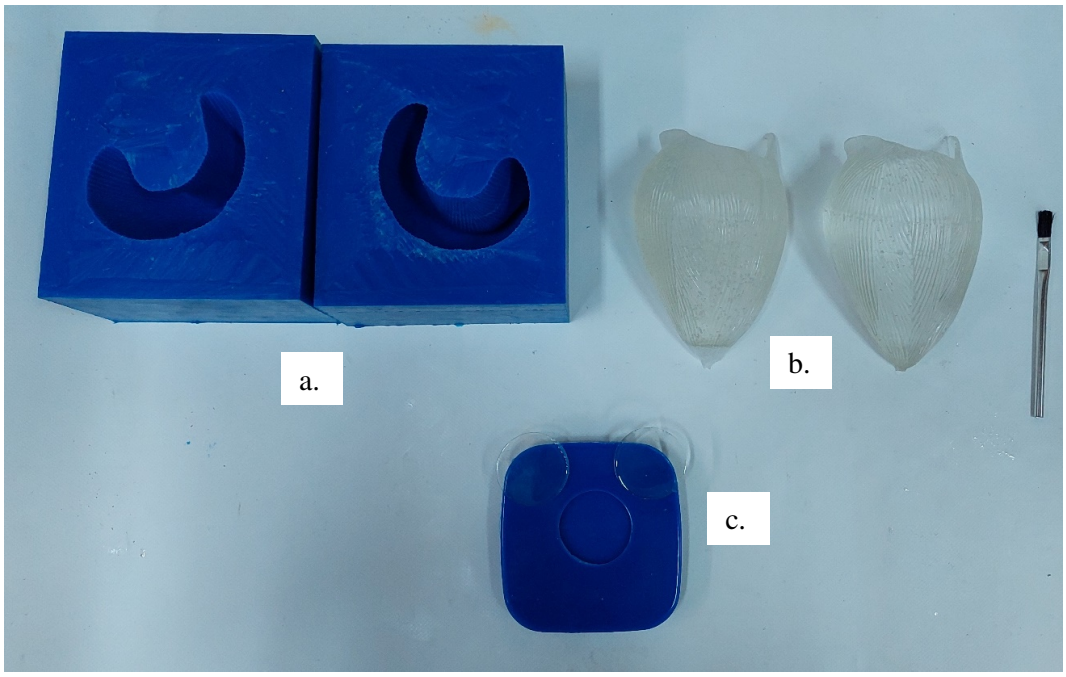

Fig. 7. a. Open mold; b. Two cast models of the left deltoid; c. The two overlapping reference discs

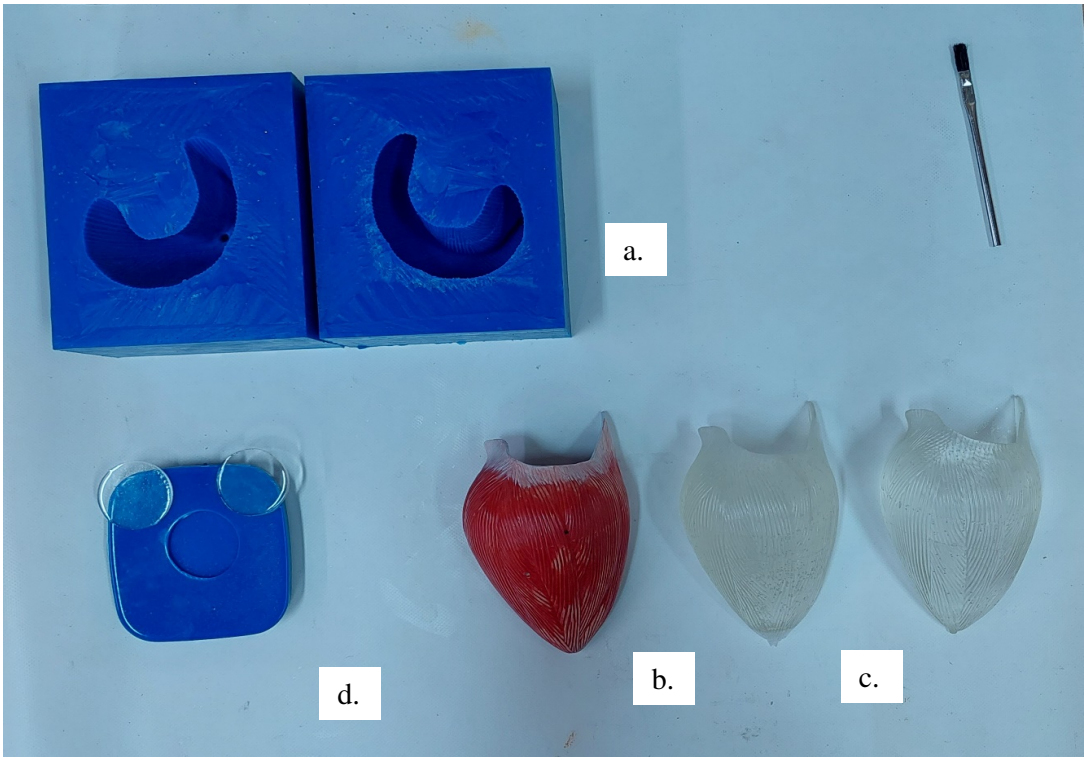

Fig. 8. a. Open mold; b. Left deltoid detached from human arm; c. Two cast models of the left deltoid; d. The two overlapping reference discs

Figure 8 is presented to verify the casting of the left deltoid mode of the investigated subject, to which dimensional corrections were made after figure 3.

4. DISCUTIONS. CONCLUSIONS

This paper is an integral part of the experimental study carried out by the Doctoral student to carry out with the thesis: "Influence of Mechanical Vibrations on the Human Body from an Energy point of view".

From the study carried out it can be said that:

1. Photoelasticimetric study of left deltoid of a human subject, requires physical modeling of the deltoid.

2. In this paper is presented the preparatory part of the application of the method, by which the left deltoid is made of epoxy oxides.

3. The work will continue with the second part, through which the deltoid request is made in the two stages, presented in figures 1 and 2, after which the segmentation of models and qualitative interpretation of the requests are applied.

4. The grouping of the two papers proves the veracity of applying the Bowen procedure to the left eltoid of a human subject.

5. REFERENCES

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METODA FOTOELASTICIMETRIEI UTILIZATA PENTRU PUNEREA IN EVIDENTA A DEFORMATIILOR DELTOIDULUI STANG AL CORPULUI UMAN. CREAREA MODELUILUI

Rezumat: Într-un grupaj de două lucrări se prezintă modul în care se utilizează fotoelasticimetria ca metodă de analiză calitativă, ce oferă posibilitatea vizualizării deformaţiilor care apar în material în funcţie de solicitarea pieselor realizate în cadrul experimentelor. În această primă parte, se prezintă crearea modelelor muşchiului deltoid stâng, al corpului uman.

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