



EXPERIMENTAL STUDY ON THE FREE VIBRATIONS OF THE LEFT DELTOID OF THE HUMAN BODY

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Abstract: The paper presents an experimental study of free vibrations performed by the left deltoid of the human body, which is removed from the equilibrium position and released. The material system assimilated to the left shoulder muscles of a human subject is subjected to a torsion vibration. Measurements are made on four human subjects, and the action of the targeted muscles is highlighted by electromyogram (EMG). All aspects of the measurement steps are highlighted and the differences due to the persons investigated are highlighted.

Key words: free vibrations, left deltoid muscular system, EMG analysis.

1. INTRODUCTION

In this paper is applied the vibrations on the muscular system of the left shoulder for the four subjects. One of the three muscles of the system is strained by an operator, and he twists the muscle. After which, the muscle is left free, and executes free depreciated oscillations [Arg 15]. The motion of the muscle will be analyzed using the electromyogram for each of them.

2. EXPERIMENTAL STUDY

The experimental study is carried out on four subjects of different sexes, different ages, different weights. Each of them was notified of the experiment. It does not carry dangerousness on the human body, so it has obtained the agreement of each to carry out the experiment and electromyographic recordings. The component of the group under investigation is shown in Table 1.

Table 1.

The Investigated Subjects

Subject	Sex	Age	Height [m]	Weight [kg]
Subject 1	F	45	1.60	67
Subject 2	F	74	1.57	56
Subject 3	F	51	1.67	66.5
Subject 4	M	66	1.70	115

2.1. Experimental procedure

It studies the free vibrations on the left deltoid edge of the subjects.

The deltoid muscle (Fig. 1) consists of three muscles positioned in the parallel [Ghe 20]:

1. the posterior edge is in the back and is fixed to the shoulder scapula,
2. the medial muscle is the largest and is centrally located, with fixation on the shoulder bone,
3. the anterior muscle is in front and is fixed superiorly to the clavícula.

In the lower part, the three muscles are fixed to the forearm bone [Osc 03], [Osc 03a].

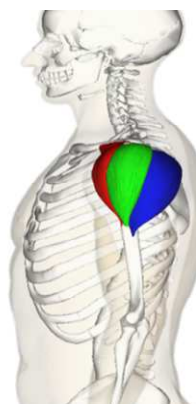


Fig. 1. Left Deltoid: Anterior deltoid (red), medium (green) and posterior (blue)

The investigation is done by applying the Bowen technique to the left deltoid of each subject [Mol 80]. This means that the posterior deltoid is removed from the equilibrium position by applying a tangential force, which will cause it to move by elongation and rotate it over the median deltoid. Hold this position for a second, after which the muscle is released. The muscle reaches its original position after performing free torsion oscillations, which are highlighted by an electromyographic recording system.

2.2. Biomedical Measurement System KL – 720. Electromyographic Modul.

The biomedical measurement system called KL – 720 of Chinese production, can carry out various studies by recording on the human body, with nine different modules. One of these studies is also given by the realization of the electromyogram [KL – 720].

Figure 2 shows the basic module of the biomedical system, to which is applied module 2, with which the electromyogram is performed. The information is captured by some sensors, which are on the body of the subject under investigation, according to Figure 3. The results of the recordings are communicated to a calculation system, and on the monitor screen (Fig. 2) the recording made at a given time is presented. The image of the screen content is saved in a file, which is analyzed by the research operator.

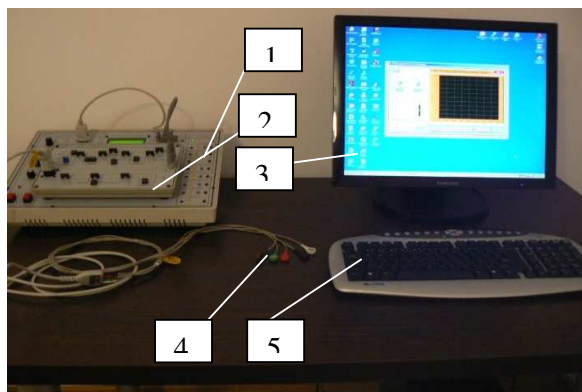


Fig. 2. Biomedical Measurement System KL – 720.
1. Motherboard; 2. Electromyographic Modul;
3. Monitor; 4. Captor Sensors; 5. Keyboard.

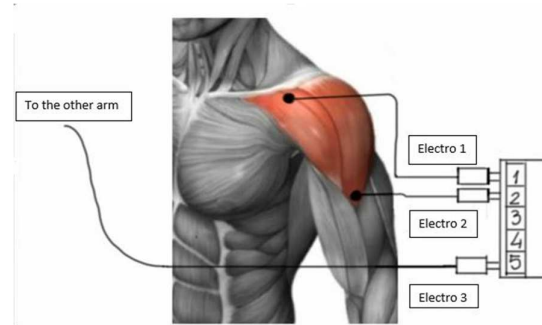


Fig. 3. Mounting electrodes for the electromyogram.

3. EXPERIMENTAL ACTION

The request of the left deltoid muscle to free depreciated vibrations is obtained by applying the Bowen technique in the sequence [Pap XI]:

- apply oblique torsion motion of the posterior deltoid, together with the rotation of the arm in front, which is positioned at right angles over the chest.
- apply a slight blow to the shoulder.
- the hand is restored to its normal position.

File registration is done in three different stages:

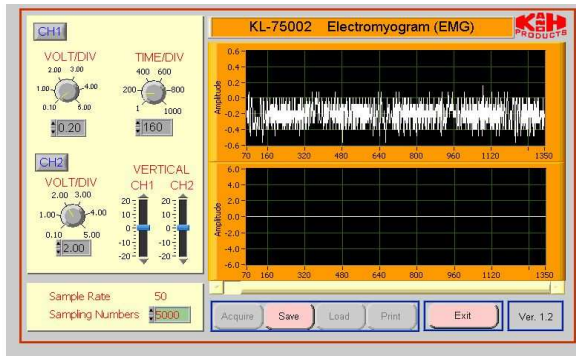
1. before to establish the state of equilibrium,
2. during the request, with the highlighting of the movements performed,
3. after the request at one minute.

3.1. Subject 1

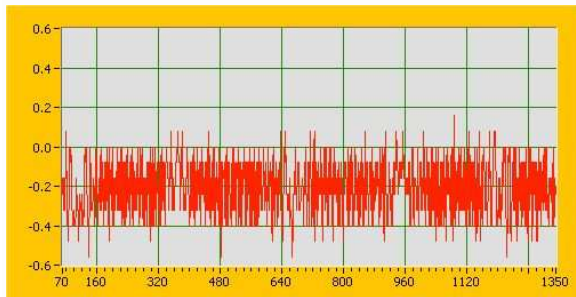
Subject 1 is a young woman, medically healthy, who does not accuse pain in the left shoulder. It is shown in Figure 4, with sensors mounted. Measurements are presented in the sequence: Figure 5 – before the application of the procedure, Figure 6 – during the procedure, Figure 7 – after the application of the procedure.



Fig. 4. Sensors Mounted on the Subject 1.



a.

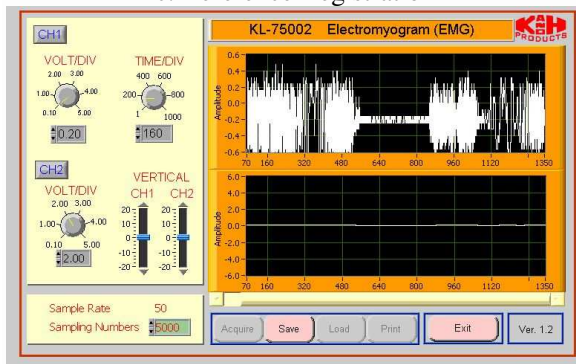


b.

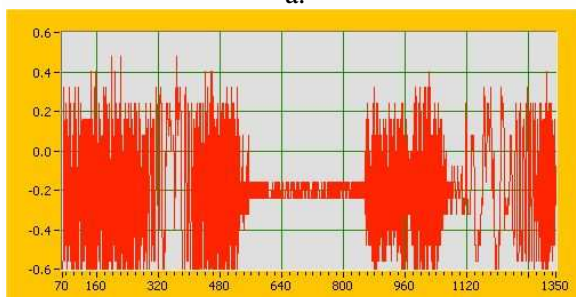


c.

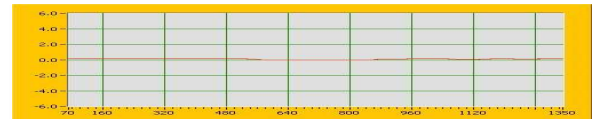
Fig. 5. Electromyogram Registered before the Motion on the Subject 1. a. Monitor, b. Electromyogram of the Deltoid, c. Reference Registration



a.

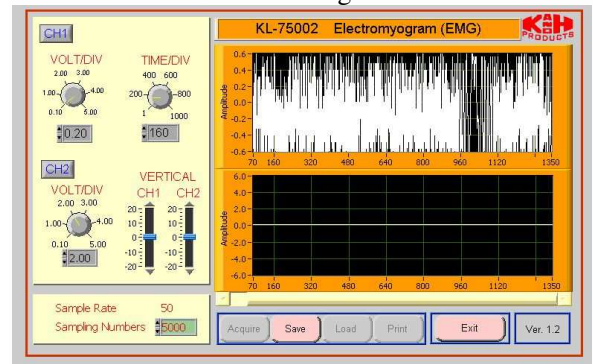


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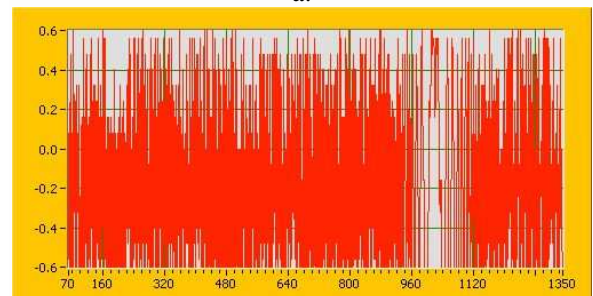


c.

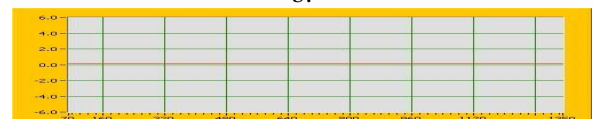
Fig. 6. Electromyogram Registered in Time of the Motion on the Subject 1. a. Monitor, b. Electromyogram of the Deltoid, c. Reference Registration



a.



b.



c.

Fig. 7. Electromyogram Registered after the Motion on the Subject 1. a. Monitor, b. Electromyogram of the Deltoid, c. Reference Registration

3.1.1. Discussion for the Subject 1

The subject 1 is in equilibrium for this action, because she is healthy, and the applied movements do not denote excessive demands in terms of the free vibrations of the deltoid.

The subject 1 has a special behavior after applying the procedure of requesting the left deltoid muscle, because the body's response to the request is much stronger after the completion of the application of the procedure.

Important observation. For the next subjects investigated, do not present the image of the monitor and the reference recording, because they have the same role as those presented in figures 5, 6 and 7 of topic 1.

3.2. Subject 2

Subject 2 is a third-aged woman who is suffering pain in her left shoulder and who requires specialized treatment, according to the Bowen procedure. This is shown in Figure 8, with electrodes mounted on the body. Figure 9 renders the recording of the active electromyogram before the request. Figure 10 shows electromyogram during the application of the procedure, and Figure 11 contains electromyogram after application of the procedure.

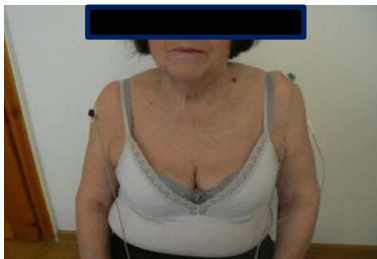


Fig. 8. Sensors Mounted on the Subject 2.

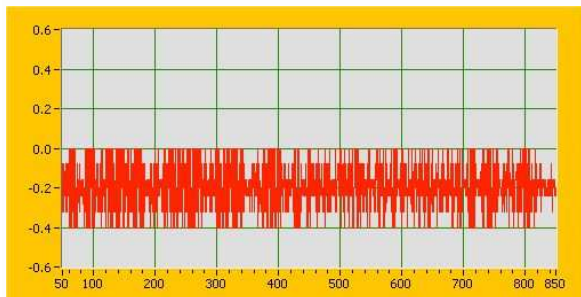


Fig. 9. Electromyogram Registered before the Motion on the Deltoid of the Subject 2.

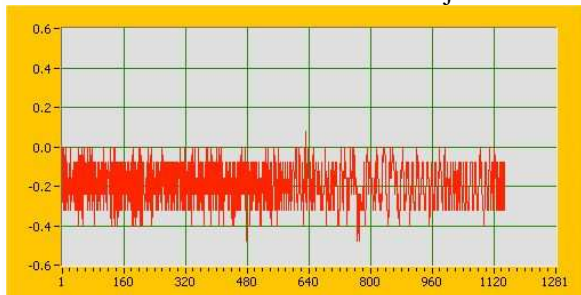


Fig. 10. Electromyogram Registered in Time of the Motion on the Deltoid of the Subject 2.

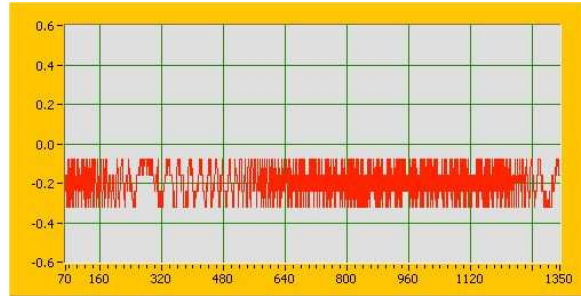


Fig. 11. Electromyogram Registered after of the Motion on the Deltoid of the Subject 2.

3.2.1. Discussion for the Subject 2

Subject 2 accuses pain in the left shoulder, which is why electromyograms have a differentiated representation.

Before the procedure, the body had an identical behavior to a person, which does not manifest pain, so it is comparable to subject 1.

During the application of the procedure the oscillation amplitude is noticeable lower, and the frequency is higher, so there was an absorption of energy from the request, which is stored in the muscles, possibly to recover.

After applying the procedure, the muscle oscillogram has the amplitude halved from the initial value, so the deltoid muscle is felt after the application of the procedure.

3.3. Subject 3

Subject 3 is a middle-aged woman, who has pain in her left shoulder, slightly overweight, for whom the Bowen treatment procedure is expected. The image of subject 3 with the electrodes applied is found in Figure 12. The electromyogram before the application of the procedure is reattached in Figure 13, the one corresponding to the application of the procedure is in Figure 14, and after application of the procedure is found in Figure 15.



Fig. 12. Sensors Mounted on the Subject 3.

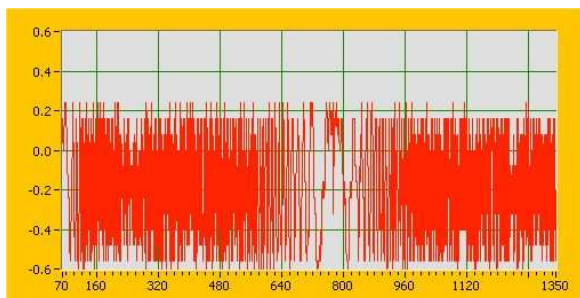


Fig. 13. Electromyogram Registered before the Motion on the Deltoid of the Subject 3.

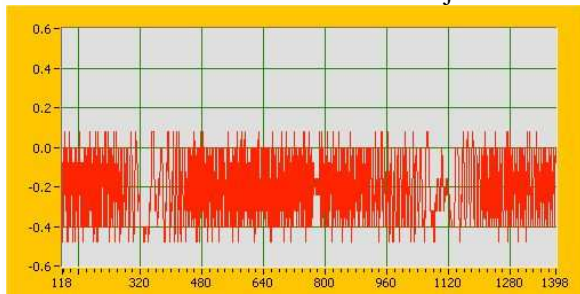


Fig. 14. Electromyogram Registered in Time of the Motion on the Deltoid of the Subject 3.

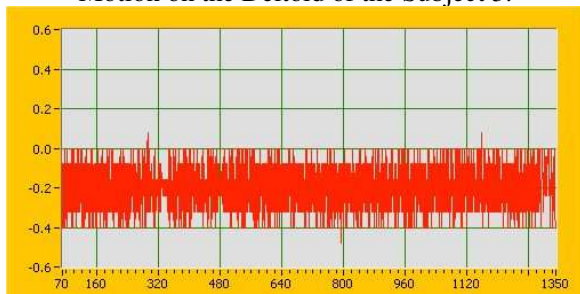


Fig. 15. Electromyogram Registered after the Motion on the Deltoid of the Subject 3.

3.3.1. Discussion for the Subject 3

From the electromyograms recorded in subject 3 it can be said that it shows a behavior like subject 2, only more emphasis, this means that the pain revised by subject 3 is stronger than that felt by subject 2.

In addition to the above, the following aspects may be taken out:

- ✓ oscillograms show a sharp imbalance, so the body's behaviour is not sufficiently well managed by the nervous system,
- ✓ there are interruptions of representations, which denote the intermittent transfer of information from captors to receivers.

3.4. Subject 4

Subiectul 4 este un barbat de varsta mijlocie supraponderal, care acuza dureri in umarul stang si care necesita tratament prin procedura Bowen. Este reprezentat in figura 16 cu electrozii aplicati in vederea efectuarii investigarii. Electromiogramele se reprezinta in figurile 17 18, 19 pentru inregistrarrile efctuate inainte, in timpul si dupa aplicarea procedurii.



Fig. 16. Sensors Mounted on the Subject 4.

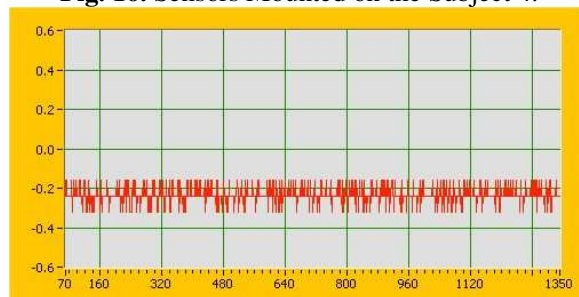


Fig. 17. Electromyogram Registered before the Motion on the Deltoid of the Subject 4.

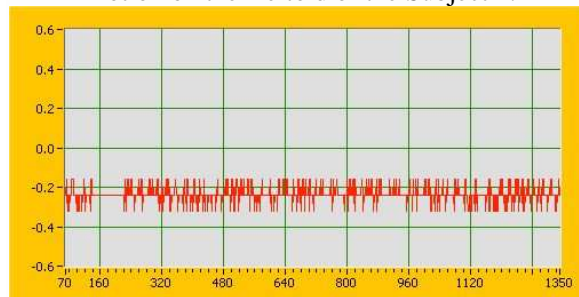


Fig. 18. Electromyogram Registered in Time of the Motion on the Deltoid of the Subject 4.

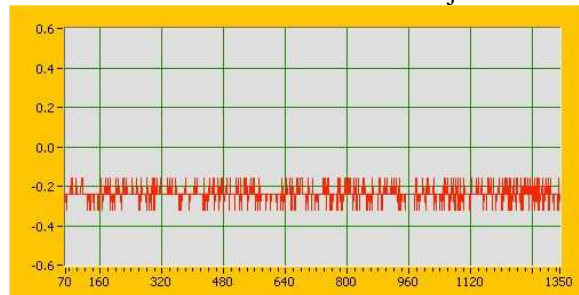


Fig. 19. Electromyogram Registered after the Motion on the Deltoid of the Subject 4.

3.4.1. Discussion over the Subject 4

The oscillators recorded for subject 4 are much different from those recorded for the other three subjects. The amplitudes of the oscillations are small, very small, which means that the energy dissipates in the body and does not contribute to the improvement of the health status of the left deltoid muscle – the one targeted.

This situation occurs due to oversizing, and the health cannot be improved by this procedure.

4. DISCUSSIONS. 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. Electromyogram can be used to investigate the palliation of the Bowen procedure on the left deltoid of the human body.
2. The state of health of a subject implicitly results from the sequence of rendered oscillograms: before, during and after the

application of the Bowen procedure devoted to the deltoid.

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STUDIU EXPERIMENTAL PRIVIND VIBRAȚIILE LIBERE ALE DELTOIDULUI STANG AL CORPULUI UMAN

Rezumat: Lucrarea prezinta un studiu experimental al vibratiilor libere efectuate de deltoidul stang al corpului uman, care este scos din pozitia de echilibru si este eliberat. Sistemul muscular asimilat muschilor umarului stang al unui subiect uman este supus unei vibratii de torsiune. Se efectueaza masuratori pe patru subiecti umani, iar actiunea muschilor vizati este pusa in evidenta prin electromiograma (EMG). Sunt puse in evidenta toate aspecte legate de etapele masuratorii si se evidentiaza diferentele datorate persoanelor investigate.

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