



THE CAPTURE AND ANALYSIS OF POSTURE PARAMETERS RELATED TO SITTING ON A CHAIR

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Abstract: *In this paper we are presenting a method to capture and analyze a parameter which influences the correct body position during sitting: the angle between shoulder, back and hip. We used inexpensive motion analysis tools in order to find the angle and then we compared it with the angle in literature, on a subject. The method is simple and can be replicated easily at institutions / companies where employees are required to sit during the main part of their daily routine.*

Keywords: *health, sitting, motion analysis, ergonomics*

1. INTRODUCTION

From the beginning of the times people use something to sit on. Everyday these things are changed so much that from sitting simply on a stone and now sitting in an armchair we are putting our health in danger.

The science which studies the sitting of people is called physical ergonomics, which is based on the analyzing the interaction between man and work environment. It helps us to find out which are the safe and comfortable ways for a man to work.

Sitting to long on a chair, especially in a bad position, causes some health issues that in time are not good for having a healthy life. Here we will study the positioning of a man at work and we will focus on some parameters of his posture, comparing them with the correct ones from literature. Also, the amount of time spent in a bad posture is of importance: it is not the same sitting on a chair at home twenty minutes per day such as sitting at work eight or more hours per day.

2. MEANS AND METHODS

As a matter of fact, we can say that a good chair is helping to stabilize the body to support a dynamic position which is comfortable in long term. The capture and analysis of the movement systems and applications in composed of two components: the capture of the human movement using video cameras or other methods and the analysis of the human movement, usually using software programs developed especially for the task.

Motion capture systems differ greatly in performance and price: there are professional laboratories where the price of equipment is high and there are systems less costly like regular or high speed video cameras and dedicated software (in some cases free to use, like Kinovea). In this case we used the less expensive form of processing the movement: a video camera which is placed in the same distance and height for all the analyzed subjects. We are taking into consideration three subjects, which are sitting in the same position during 8 hours of work, doing their usual activities. During this time, we are recording them and after that the videos are processed and analyzed with a software program (a combination of Excel tables and Matlab programming). We used colored stickers that we have put into some important reference points on their bodies, such as shoulder, elbow, hip, knee and ankle. We can find out exactly how long and how much these important points can move in a certain way. With the delimitation of the edges we will find out how these three students should change their sitting position to reach the best for their body

and health. The program we use for studying the movements is the Adobe After Effects. This helps us record the path for every point during time. After that, we saved the data into a table using Microsoft Excel. Thus, we can calculate the angles that should be corrected. For instance, to calculate an angle we need to know three points. The program helps us to process these videos into tables and draw graphics that will help to determine for each subject the issues they might have during sitting.

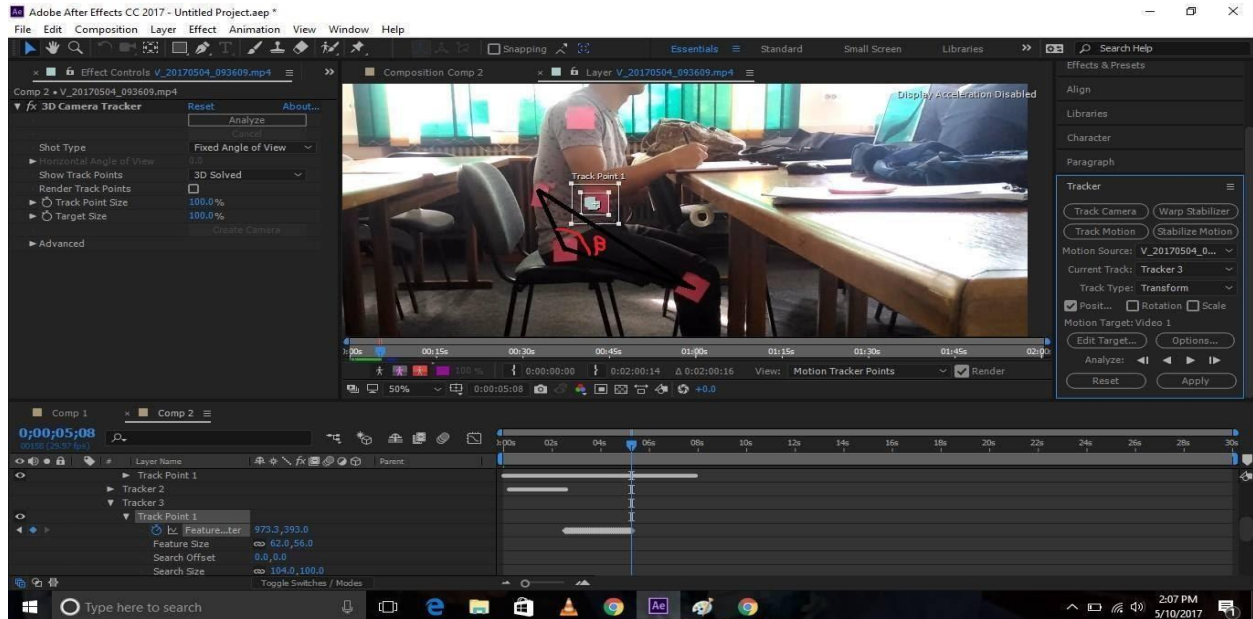


Figure 1: The angle between hip, knee and back

3. THE ANALYSIS OF THE SUBJECTS

Sitting too much in a bad position can cause diseases, which can influence our life: lower back pain, backache, joint problems and circulatory problems. It is advisable for companies which offer jobs which require long term sitting to ensure the circumstances for a healthy sitting and make sitting rooms where the employees can recover and rest. For instance, in Romania, to work in a call center is very popular among college students. They have to work for four to eight hours sitting more or less in the same position. This may cause further problems if they sit in a wrong position. A large number of these students are complaining about their pain in the back and legs. In this situation we can easily understand that they have a scoliosis, circulatory problems and limped muscles.



Figure 3: Main points of interest, captured

To be able to speak of an ergonomic point of view, we can talk about changes that help human health. We were spending a couple of hours with 3 persons to understand the problems and to advise changes in their sitting and the settings of the armchair. Color-coded stickers have been used to narrow the gap between the problems and how they can avoid them. The method we used is an inexpensive way to find different motion and geometric parameters in order to understand what needs to change. This is unique for different categories of people: for instance, we can't use the same chair setting for a tall and a short man. Here, the first ten angles of shoulder-back-hip from one subject are showed as an example. According to studies, the healthy way to sit on a chair is to make sure you relax your shoulders. This implies some factors: for the chair, it needs to have a backrest that supports your lower back; the feet always need to be flat on the floor; the legs should be bent in a 90- to 110- degree angle; the arms also need to be 90 to 110- degrees bent. The hip angle should be between 90 and 120 degree, especially for long term sitting, and also the ankle angle should be between 100 and 120 degrees. It is also important to have a maximum trunk inclination of maximum 30 degrees, so a shoulder-back-hip angle between 180 and 150 degrees.

Table 1: The Shoulder-Back-Hip Angle (degrees)

Nr. Crt	Angle
1	128.93
2	130.89
3	128.94
4	128.60
5	125.60
6	128.58
7	128.57
8	128.73
9	128.75
10	129.00

In our simple example, we can easily see that the shoulder-back-hip angle was always exceeding the maximum recommended 150 degrees (maximum bending of 30 degrees) for all the 10 recording sessions, for the vast majority of the time he was spending sitting. In conclusion, our subject needs to have a better position in order to have a healthier life. Using this simple method, we now can recommend what he should change in his posture in order to avoid serious health injuries in the future.

4. CONCLUSIONS AND FUTURE WORK

In conclusion sitting in a bad posture can lead to different health issues. If the body sits in a bad position every day, it gets worse ending in possible disease. There is a lot of work in the world to find solutions for a better posture, to find out which is the common denominator, to see which position is better in a long time in order to avoid health problems. The method we propose here is an inexpensive one, which companies and interested individuals can use to evaluate their sitting posture and adapt consequently.

REFERENCES

- [1] https://www.ccohs.ca/oshanswers/ergonomics/sitting/sitting_position.html
- [2] Réthelyi M. - Szentágothai J., Funkcionális anatómia, Medicina Kiadó, 2014
- [3] Juhász I., Orosz Gy., Paróczay S., Matematika 9, Nemzeti Tankönyvkiadó, 2009