Kansei Engineering, Vol. 40, 2022, 23–28
https://doi.org/10.54941/ahfe1001756

Suggestions to Make Working in A Sitting Chair More Comfortable

Saeko Imura[1], Ryuichi Yamazaki[2], and Noriko Hashida[3]

[1]Mechanical Engineering at the Shibaura Institute of Technology, 3-9-14 Shibaura, Minato-ku, Tokyo 108-8548, Japan
[2]YAMAZAKI Co.,Ltd. 439-1 Toguchi, Sakado-city, Saitama 350-02276, Japan
[3]College of Design Engineering, Shibaura Institute of Technology, 3-9-14 Shibaura, Minato-ku, Tokyo 108-8548, Japan

ABSTRACT

When telework was recommended to prevent the spread of covid-19, more and more people began to work in sitting chairs to improve their work environment. However, there are some issues that can be seen when working in a seated chair. In this study, we identified the factors that cause problems when using a sitting chair and the factors that make work more comfortable, and proposed equipment to be used with a sitting chair. In this paper, sitting chair refers to a legless chair.

Keywords: Sitting chair, Legless chair, Telework, Kansei engineering

INTRODUCTION

In order to prevent the spread of COVID-19, telework, which allows people to work from home, has recently been recommended (Ministry of Internal Affairs and Communications, 2021). At Nitori Holdings, which sells furniture and household goods, mail-order sales accounted for 9.7% of consolidated sales, up 2.9 percentage points from the previous year, and data shows that e-commerce-only products, mainly large furniture such as chairs are driving strong mail-order sales (Ohta, 2021). These indicate that more and more people in Japan are using seating chairs to work on their PCs in order to create a work-at-home environment.

While the demand for seating chairs is increasing, most of the papers on seating chairs are for nursing care purposes, such as (Kajihara, 2014) and (Shinbori et al., 2011), and there are few papers on the use of seating chairs by able-bodied people when they work long hours, such as teleworking. The basic experiments in this study have revealed several stresses associated with working in a sitting chair. The experiment was conducted by having the subjects sit in a chair for 30 minutes for evaluation and observation. (1) relax and watch TV from two meters away, (2) look for photos on a smartphone, (3) place a PC on a table and type a sentence, and (4) stand up from a chair. The subjects were four in total, two males and two females. As a result, many people answered that they felt stressed because the height of the low table and chair did not match, causing them to lean forward in posture while working at the PC, putting a strain on their back and hips.

Figure 1: Cushion model that we made.

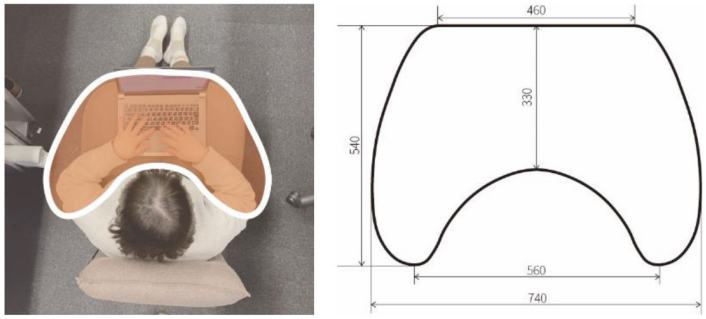


Figure 2: Size of the cushion model produced.

Therefore, instead of a low table, we propose a PC cushion to be used with a seating chair, which is easy to adjust the height by yourself and easy to introduce in a space-saving manner.

PRODUCTION AND EVALUATION OF PC CUSHION MODELS

First, we conducted an experiment of PC work using a cushion for smartphones (made by Yamazaki) as a base for PC cushions. As a result, it became clear that "the height of the work surface," "stability when using the keyboard," and "the size of the top surface as the work space" were important for work comfort.

Therefore, we made a model of a PC cushion for experimentation (see Figure 1). Experiments with existing products showed that the lack of elbow support by cushions put a strain on the wrists. Therefore, the shape of the cushion was to be such that a PC (13-15 inches) could be placed in the center and arms could be placed naturally on either side (see Figure 2). We also took into consideration that the PC should be large enough to be used at least 40 cm away from the eyes, referring to Fujitsu's notes on using laptops (Fujitsu).

Evaluation Experiments With Different Sizes

This size is available in three different heights: 150mm, 170mm, and 190mm. Using these cushions, we conducted an evaluation experiment to see how the height felt, how the size felt, and how the stability felt. Each subject was asked to work on a PC for 10 minutes. The evaluation experiment was conducted with a 5-minute break in between so that fatigue from the work would not

Table 1. Evaluation of each cushion height.

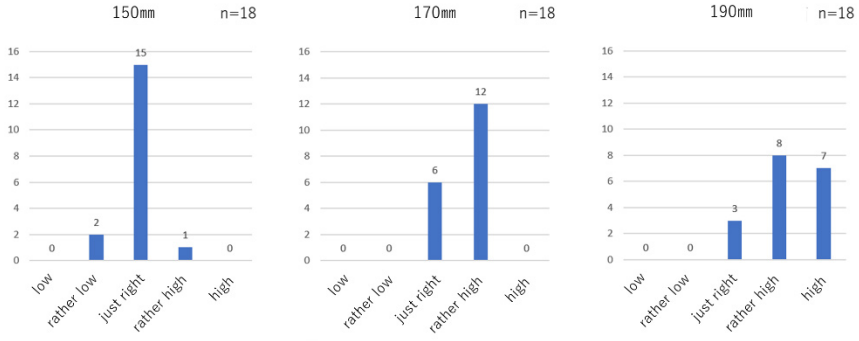
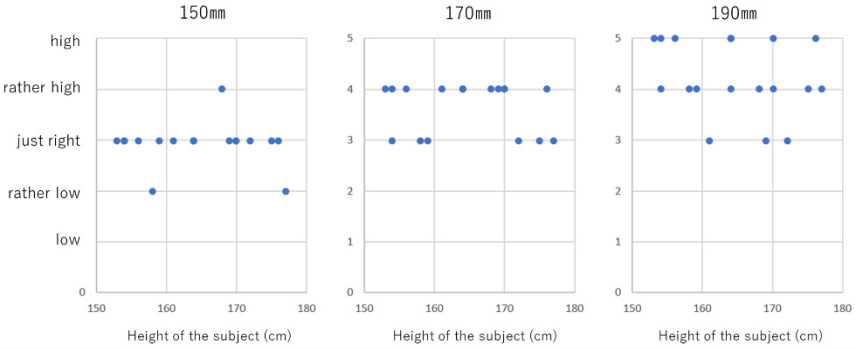


Table 2. Relationship between the height of the subject and the height of the cushion.



affect the results. The content of the PC work was left up to the subjects. The subjects were 18 students of the university, 9 males in their 20s and 9 females in their 20s.

The first thing to evaluate is the height. After each operation, a questionnaire was given to the participants to evaluate the subjectivity on five levels: "low," "rather low," "just right," "rather high," and "high". The ratings at each of the three heights are shown in Table 1. The most common answer was "just right" when the height was 150mm. However, one-third of all respondents answered that it was "just right" even at 170mm. In order to clarify whether this tendency is influenced by height, the following analysis was conducted (see Table 2).

Next, we conducted an experiment on the size of the work surface.

A questionnaire was used to subjectively evaluate the work space in five levels: "small," "rather small," "just right," "rather large," and "large. As shown in Table 3, it can be said that the maximum number of people increased as the height increased. Although the size of the work surface itself did not change, some respondents reported that the size of the work surface increased as the height increased.

Results and Discussion of the Experiment Using Cushions of Different Heights

From the above results, it can be said that the height of 150mm is the most suitable for PC work, since the largest number of people answered "the height

Table 3. Size evaluation for each cushion height.

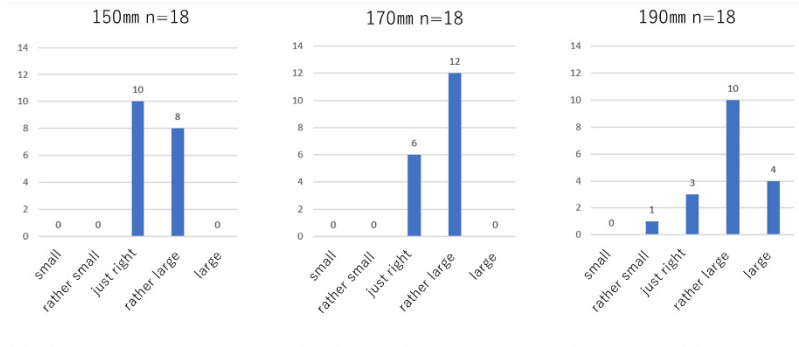


Figure 3: Experimental results for setting the ideal top surface sizes.

is just right" and it was evaluated regardless of their height. From the observation results, it is possible to adjust the height slightly depending on how the legs are placed, so the height of the cushion is decided to be 150mm. On the other hand, the size and stability remained an issue. Regarding the size, some people felt that the top size was a little large when the cushion height was 150mm. Also, some people answered that the size of this experimental model was too large considering that they would actually use it at home. As for the stability, no constant sense of stability was obtained at any height. From the interviews at this time, it became clear that there were two types of instability, the first being "the PC slipping on the work surface" and the second being "the cushion not blending with the legs. These can be solved by adjusting the type of material in the cushion.

Determine the Optimum Top Surface Size for Your Work

Next, an experiment was conducted to determine the optimal top surface size for working on a cushion with a height of 150mm. After having the subjects work on the PC for 10 minutes, we asked them to indicate the position of the size they thought was ideal by placing a sticker on it, and the results were tabulated (see Figure). The content of the PC work was left up to the subjects. The subjects were 18 students of our university, 9 males in their 20s and 9 females in their 20s.

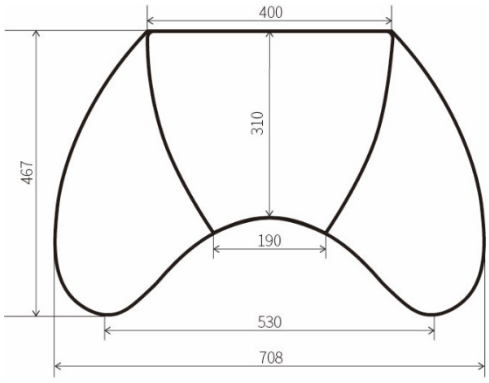


Figure 4: Size of the final proposal.

Figure 5: PC cushion for final proposal.

Experimental Results and Discussion on Top Surface Size and Stability

Based on this result, we changed the size to the one shown in Figure 4. As for the stability during work, the instability caused by the PC sliding was solved by using a leather material on the top surface of the cushion. The instability caused by the cushion not blending with the legs was solved by using a two-layer cushion structure, with beads and cotton on the leg side and urethane foam on the PC side.

CONCLUSION

In this study, we clarified the stress of working in a sitting chair during telework, and aimed to solve it by proposing a cushion for PCs. Through questionnaires and interviews, we aimed to achieve comfort for users from three major perspectives: cushion height, top surface size, and stability. The proposed PC cushion has a height of 150 mm and the top size is shown in Figure 5. In addition, the materials built into the cushions were made composite to increase stability. As a result of the final verification experiment with

12 students (5 males and 7 females), the average value was 4.58 in the overall evaluation (5-step subjective evaluation of the comfort of the work). About 60% of the subjects gave a perfect score of 5, and no one gave a score of less than 3. However, there was some variation in the evaluation of stability. In addition, comfort is thought to be related to the material and color of the cover, room temperature, and humidity, and these should be future issues.

REFERENCES

Fujitsu. (2021) Posture when using a computer, Fujitsu Website: https://www.fujitsu.com/jp/about/businesspolicy/tech/design/ud/vdt/index-page3.html

Kajihara Akira. (2014) "Development of a seat elevating wheelchair with seat function", Life Support Society of Japan, Vol. 26, No. 1, p. 33.

Ministry of Internal Affairs and Communications (2021) Proactive use of telework as a countermeasure against new coronavirus infections, Ministry of Internal Affairs and Communications Website: https://www.soumu.go.jp/main_sosiki/joho_tsusin/telework/02ryutsu02_04000341.html

Ohta Shunsuke. (January 14, 2021) "Nitori HD's mail-order sales up 59% in the third quarter, maintaining strong sales on nest egg demand", Japan Net Keizai Shimbun Website: https://netkeizai.com/articles/detail/2746

Shinbori Masahito, Sadahiro Keisuke, Murao Yashio and Nakatsuji Takeshi (2011). "A study on application of new type linear drive unit: application to the assistant chair use for standing up", in: Journal of Japan National College of Technology, Vol. 16, No. 3, pp. 17–22.