

Summary

Three-dimensional dynamic seating for more efficient office work

Study on the impact of the three-
dimensional office chair system ON®
on cognitive skills and the subjective
feeling of well-being

Boris Feodoroff

Ingo Froböse

November 2011

Foreword

The debate on adapting office workspaces on a needs-based and appropriate manner has long called for a more active concept that fosters more physical activity. A lack of movement and physical inactivity are seen as risk factors for various conditions such as obesity, heart and circulatory problems, diabetes type 2, but also muscle and skeletal diseases (Manson et al., 2004; Hamilton et al., 2008; Owen et al., 2009; Thorp et al., 2009). Integrating movement into our day-to-day lives is extremely important for our health and consequently for socio-economic reasons too. Studies demonstrate that sitting still in offices does lasting damage to health. Activity undertaken after the end of the working day cannot adequately compensate for the negative effect of this long period of sitting still (Vlahos, 2011; Judson, 2010). The Centre for Health at the German Sport University Cologne published a report entitled “A new approach to ergonomics in the office – an investigation of the biomechanical effects of a new office chair system” (2009). The report showed that three-dimensional seating on Wilkhahn’s office chair ON gives people back freedom of movement in all its dimensions, both from a physiological and anatomical standpoint. ON allows the body a new and more varied scope of movement.

But it is about much more than just health. Previous studies confirm the positive impact of movement on cognitive powers and a sense of well-being. For example, the cognitive powers of senior citizens are examined in relation to their level of physical activity. The authors discovered that physically more active people also achieve better cognitive results (see also Abbott et al. 2004; Albert et al., 1995; Laurinet al., 2001; Lytle et al., 2004; Weuve et al., 2004; Yaffe et al., 2001). Nowadays, the principle of an active break for children and young people is a common concept when the goal is to boost attention spans in day-to-day school life (see also Dordel, 2003).

Furthermore the positive interaction of movement and a feeling of well-being has also been borne out by various studies (see also Neumann & Frasch, 2007; Woll & Bös, 2004).

Therefore, the goal of this field study is find out whether and to what extent the three-dimensional dynamic seating and the much greater range of motion that ON offers can also lead to improvement in cognitive powers and a feeling of well-being in office workers.

Method

The following questions are a result of the objective set: can three-dimensional dynamic seating lead to an improvement in office workers’ attention spans and powers of concentration? Does three-dimensional dynamic seating also provide more comfort in the office and can it therefore have an impact on the subjective feeling of well-being?

The Centre for Health then developed a methodological approach that enables fundamental, scientific observation of the impact of three-dimensional dynamic seating in relation to the powers of concentration, attention spans and subjective feeling of well-being.

The field study was carried out for 12 weeks in a large office complex belonging to the German healthcare insurance company AOK in Cologne. Some 80 people took part (42 women, 38 men) aged between 23 and 59 (average age 43). Levels of education ranged between six per cent with basic school qualifications, 36 per cent with average school qualifications, 22 per cent with higher qualifications with a practical leaning, 34 per cent with higher academic qualifications and two per cent with university qualifications. Participants were divided into two groups of 40 each (a control group and a trial group). Participants went about their normal activities that they carried out while seated. These activities ranged from simple to complex tasks.

The only difference in the trial group was that the previous office chairs were replaced by ON office chairs. From the second week after the start of the study, the trial group carried out their day-to-day office work using ON swivel chairs, while the control group continued with the existing chairs.

The Frankfurt Adaptive Concentration Performance Test (FAKT II, Testform FAKT-S) was used to identify concentration performance. In terms of execution, analysis and interpretation the procedure is objective. All the results are calculated and printed out fully automatically. The result sheet contains the concentration performance value, the concentration accuracy value, the concentration consistency value and the percentage rankings (also called standard values) for the three test values. These show how the test and control group perform in relation to the statistical reference.

Table 1: statistical reference for percentage rankings and their frequency

Frequency	Percentage ranking	
4%	97-100	outstanding
7%	90-96	
12%	78-89	
17%	61-77	above average
20%	40-60	average
17%	23-39	lower than average
12%	11-22	below average
7%	4-10	
4%	0-3	

The concentration tests were carried out at both testing periods around 3 p.m. (give or take an hour). In other words they were performed when the body is usually at its lowest ebb because

movement-induced activation of the metabolism at this point in the day has the biggest influence on concentration performance. In socio-economic terms this is where the most interesting potentials lie if reducing office workers' drop in performance during the second half of the day are to be successful.

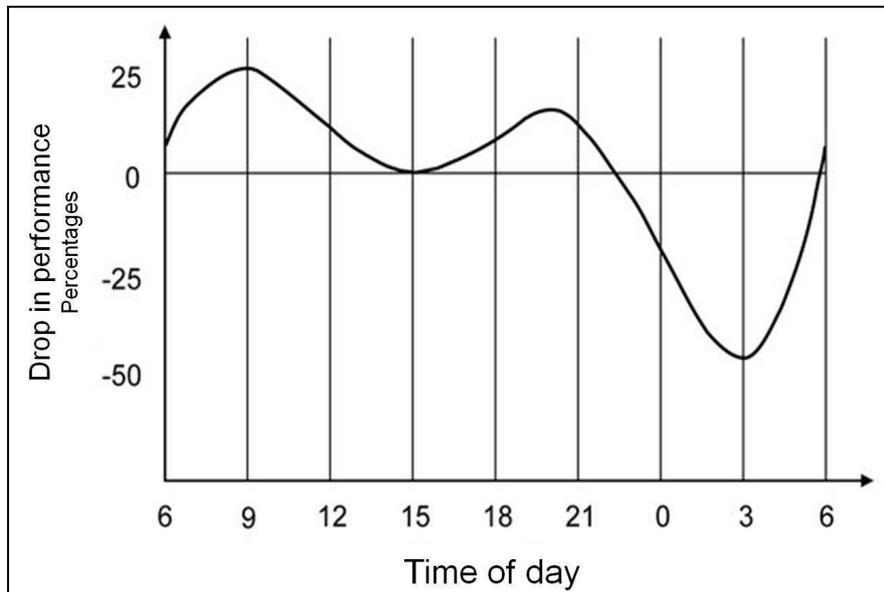


Figure 1: diagram of physiological performance over a day (according to Hildebrandt et al. 1998)

The following tests were carried out and analysed:

- tests on the powers of concentration and attention spans when the body is at its lowest ebb at the beginning (before ON was used) and at the end of the field study (FAKT II);
- repeated, standardised, general questions on the subjective feeling of well-being in order to preclude any distortion of the study due to external factors that might have an impact;
- repeated questions on the movement behaviour, effects and the feeling when sitting in the context of the seating.

Results

Concentration performance

The FAKT II adaptive concentration test was carried out and measured at two points in time. The first measurement period is before the trial groups use of ON over 11 weeks. The second measurement period is 12 weeks later.

The standard values' medians were used for each parameter for the statistical analysis and illustration. Only the results of test persons who carried out the initial and final test are taken into account [trial group n=26; control group n=25].

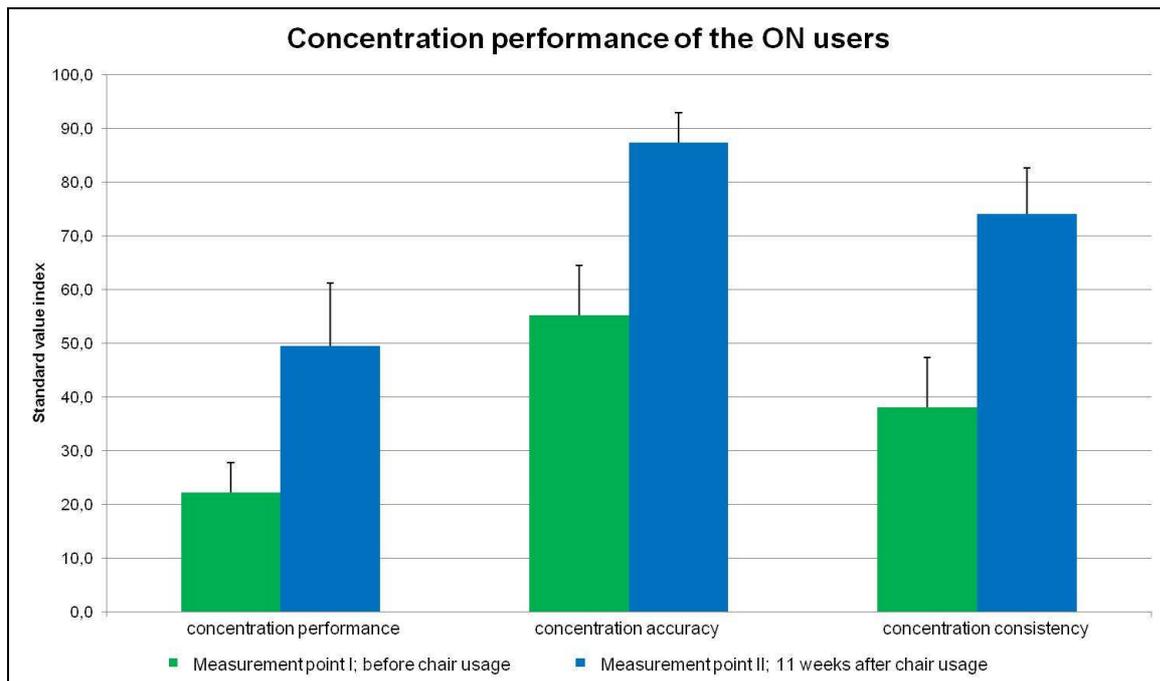


Fig. 2: the average concentration performance of the ON users during the initial and final test. The median values and standard faults are shown.

It is noticeable that the ON users improve substantially in all three areas after 12 weeks (concentration performance, accuracy and consistency).

The concentration performance increases from a below-average index value of 22.2 to the average value of 49.5. In terms of concentration accuracy, those taking part improve from an average value of 55.2 to the outstanding value of 87.3. The concentration consistency parameter also shows an improvement of one value in the lower than average range (38.1) to a value that is in the above-average range (74.0).

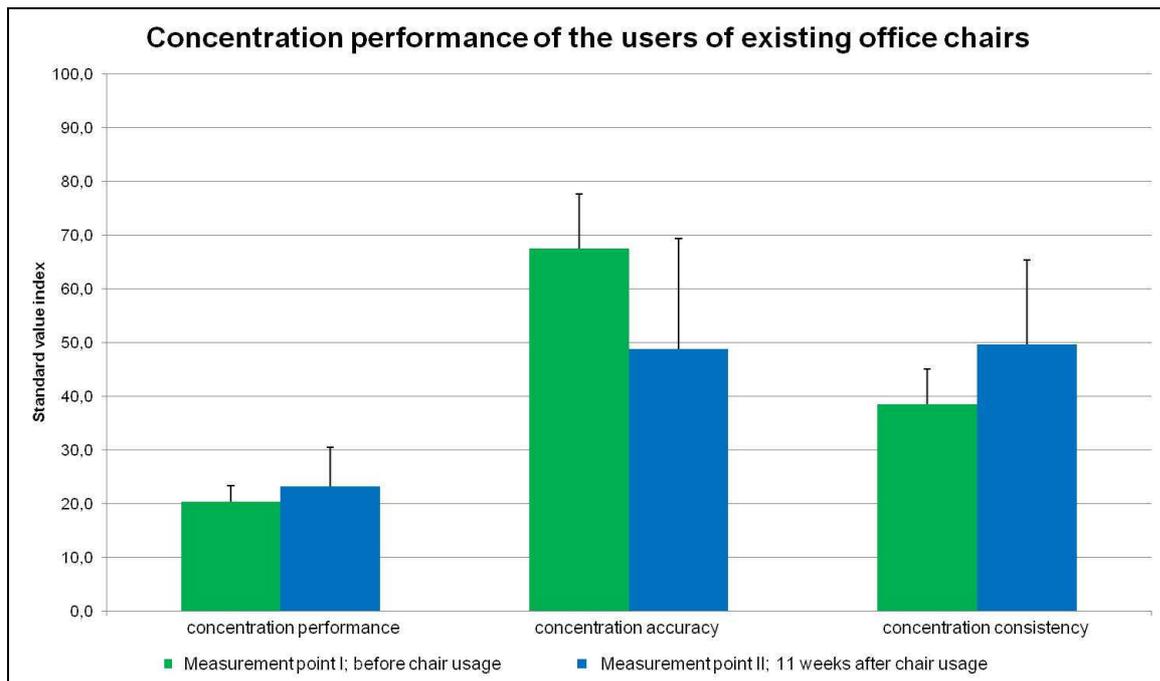


Fig. 3: the average concentration performance of the control group during the initial and final test. The median values and standard faults are shown.

The analysis of the control group’s concentration tests showed that on concentration performance the group has approved very slightly on average (from 20.4 to 23.2). However, at both measurement periods they are under average, or bordering on the lower than average range. During the final test, concentration accuracy fell on average from 67.5 (good range) to 48.8 (average). Concentration consistency improved from 38.5 (below average) to 49.6 (average). As a result, the control group is either in the average range or below in all areas.

Because the body is at its lowest ebb during the measurement period (3 p.m. give or take an hour), the concentration performance of both groups before the trial is below average to average as expected.

After 12 weeks, there is a noticeable increase in the three concentration performance parameters (fig. 2) of the trial group that has been given ON. This means that people using ON can now correctly respond to the tasks set by FAKT II more quickly and more frequently than they could during the initial test. The increase in concentration consistency also shows that better concentration performance is produced more consistently.

In comparison with the control group, all three parameters are also at a much higher level during the final test. The control group shows no improvement in concentration performance across the board and remains in the below average to average range.

The three-dimensional, freely combinable movement options ON offers allow a much more varied and more natural range of movement on the part of people sitting it. The improvement in the trial group’s ability to concentrate could be a result of this extra scope of motion offered. It shows that three-dimensional dynamic seating is actually implemented on ON.FAKT II’s objective measurement results are confirmed by analysing the accompanying questions. Depending on the question concerned, these are only put to the trial group, or the trial group and the control group.

Repeated questions on the movement behaviour, effects and comfort of the seating

During the course of the study, online questions were asked in order to evaluation specific assessments or possible changes.

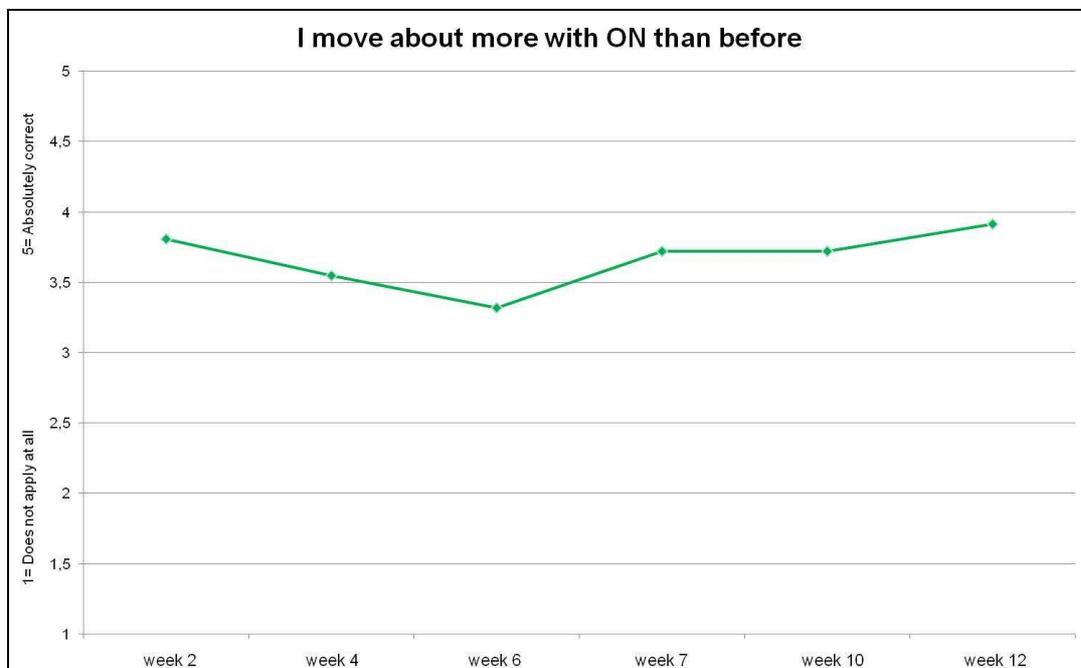


Fig. 4: diagram of the subjective assessment of the ON group test persons at certain measurement periods on the question of whether they move more due to ON than previously on conventional office chairs.

The graph shows a slight fluctuation in the curve. Apart from the median value in week 6 (3.3) all median values range between 3.6 and 3.9, or in other words the group tends to agree with the statement.

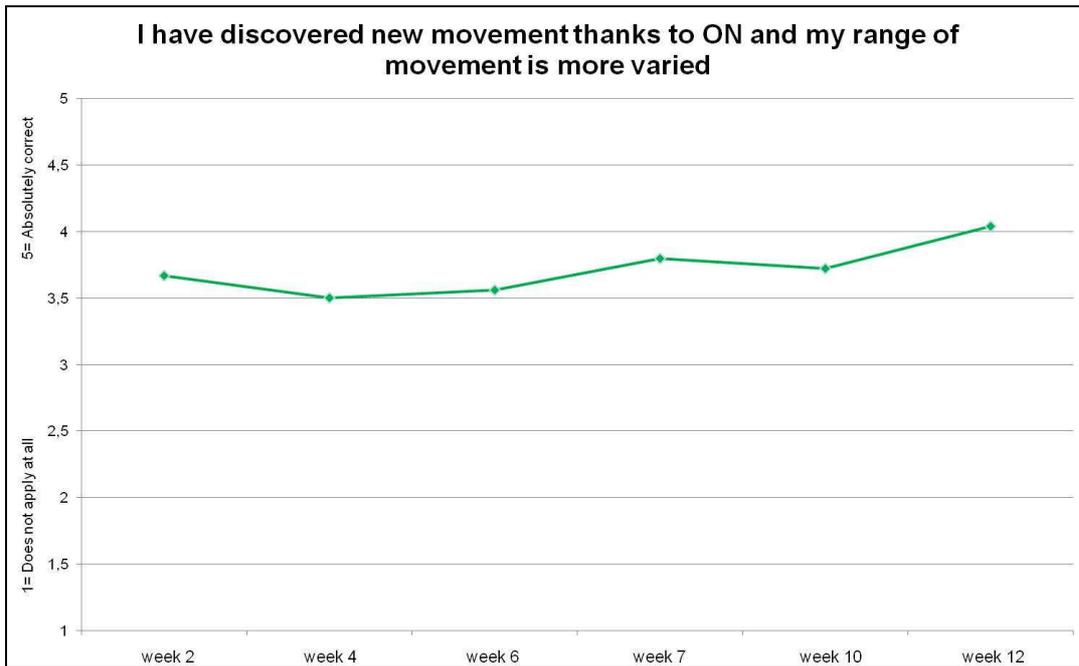


Fig. 5: diagram of the subjective assessment of the ON group test persons at certain measurement periods to the question of whether they have discovered new movement thanks to ON and whether their range of movement is more varied

The above curve shows a slight increase. The median values lie between 3.5 and 4.0. The majority of the group also agrees with this statement.

The following three theories look at the possible impact of this change in behaviour. From week 4, the average values stating agreement with the next statement rose from 3.4 to 4.1.

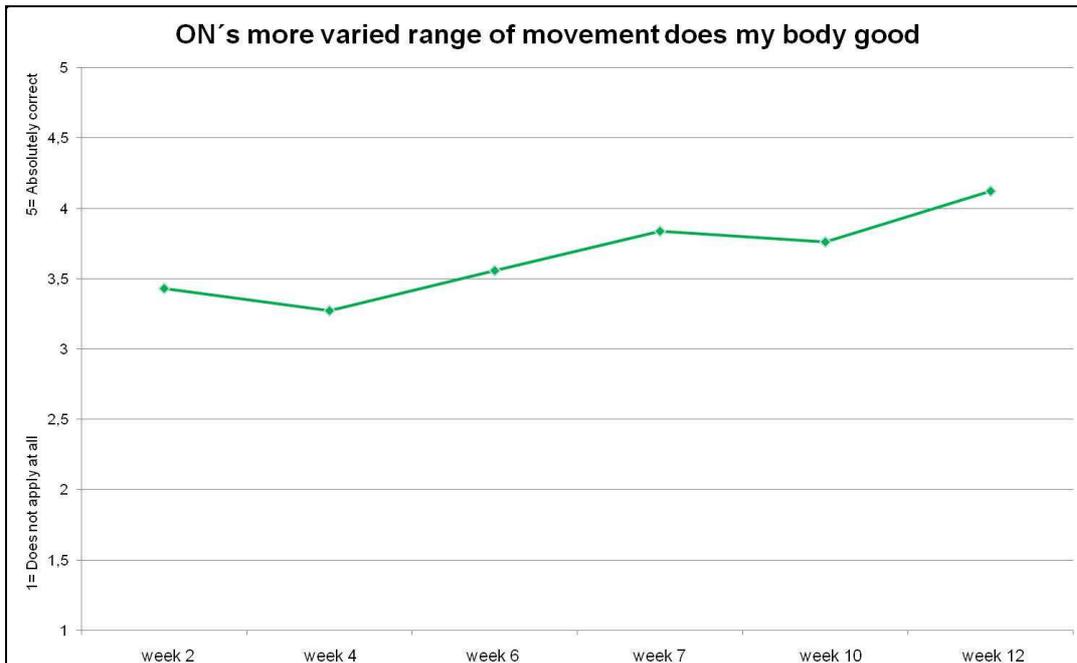


Fig. 6: diagram of the subjective assessment of the ON group test persons at certain measurement periods to the question of whether the more varied range of movement ON offers does them good

This item shows that the subjective use of ON for the physical feeling of well-being of the people taking part was increasingly felt to be positive. At the beginning the movement options tended to be assessed neutrally with a positive tendency, but at the end assessments were at a high level. Assessments on better work performance also show a slightly upwards curve.

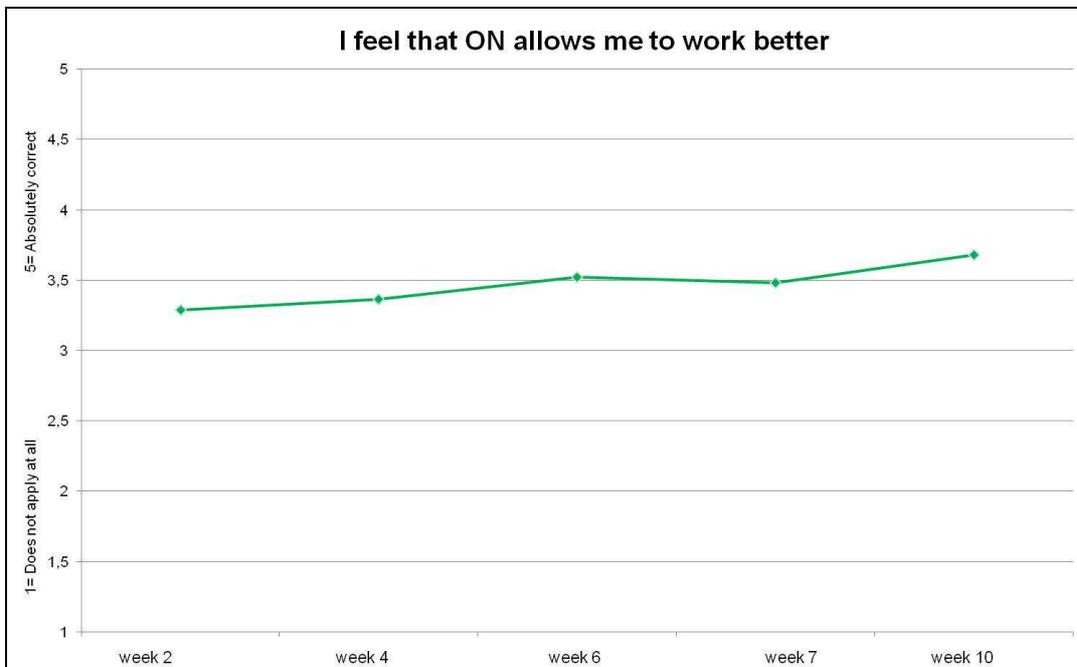


Fig. 7: graph on the subjective assessment of the people on the ON group at certain measurement periods to the question of whether they have the feeling that they can also work better on ON

From a figure of 3.3 during the initial test, the figure rises to 3.7 in week 10. During the course of the study more and more ON users feel better supported by the chair during their work.

This positive assessment is reflected when users look back on the following item as regards the feeling of physical well-being after completing the test (n=25).

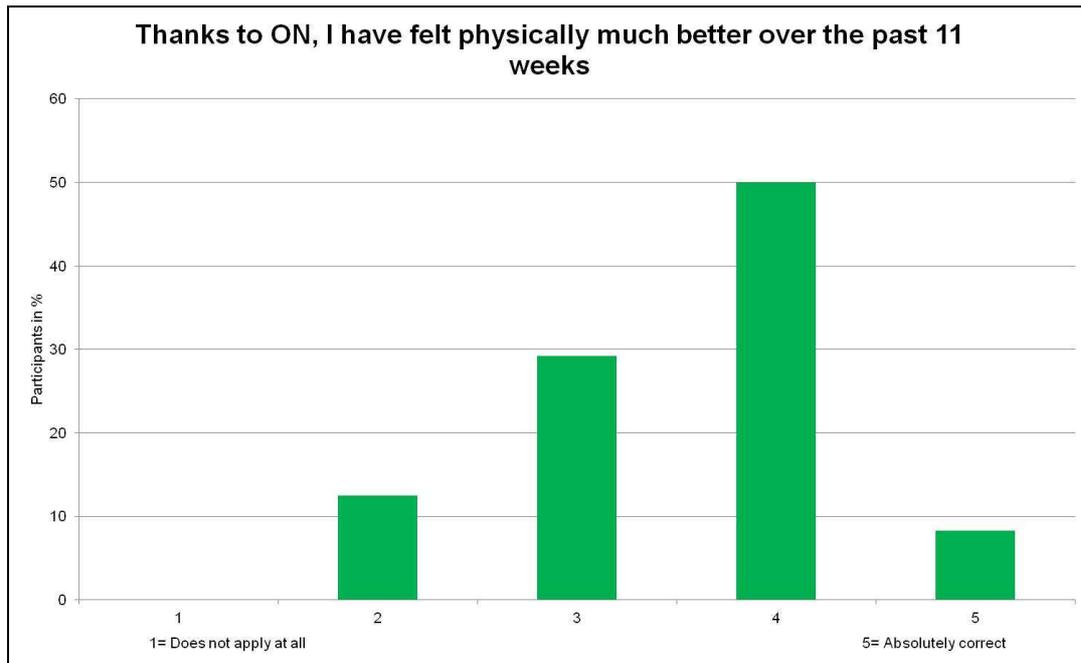


Fig. 8: graph on the subjective assessment of the ON group users to the question whether their physical feeling of well-being has improved over the last 11 weeks thanks to ON

At a median value of 3.5, 58 per cent believe that ON has helped improve their physical feeling of well-being over the past 11 weeks.

After the familiarisation period, test persons are asked about the extra movement ON offers (four weeks after starting to use ON).

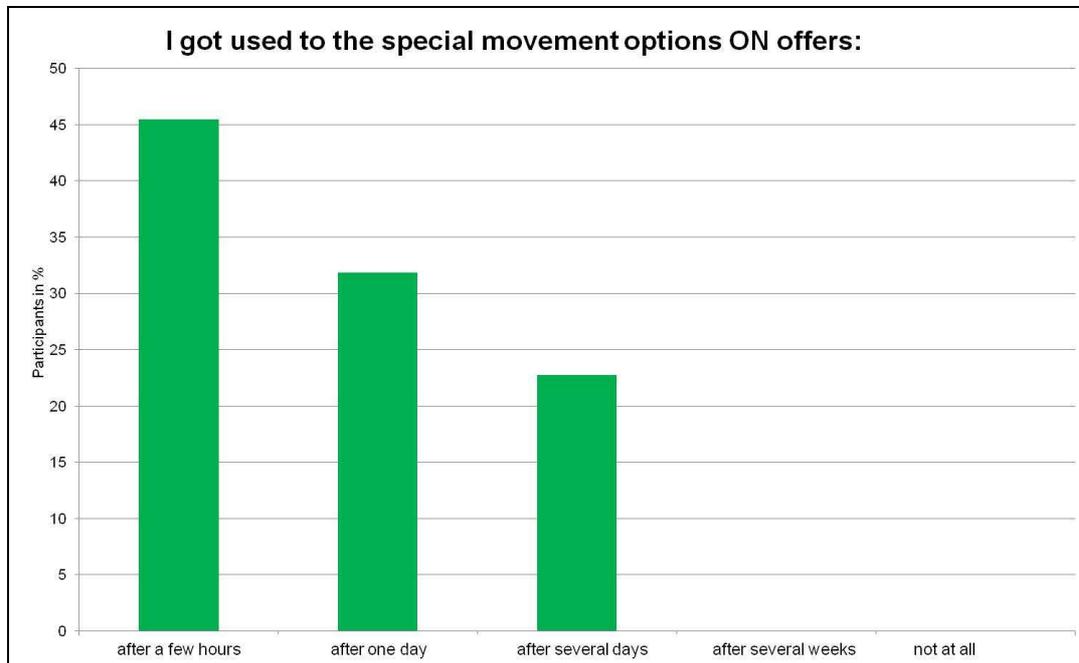


Fig. 9: graph of the subjective assessment of the ON group on how quickly they got used to the special range of motion ON offers.

The percentage of answers of all those taking part (n=24) is shown. In this case, a noticeable aspect is that no ON users have selected “after several weeks” or “not at all” as answers. Furthermore, the highest percentage (45 per cent) is achieved for the "after a few hours" option. A total of 32 per cent say that they had got used to the range of motion ON offers after “just one day”. On the other hand, less than a quarter of the people taking part say that getting accustomed to ON took several days (23 per cent).

Just as important as the natural nature of the movement is the ease with which the chair can be adjusted. Both groups were questioned so that any differences could be established.

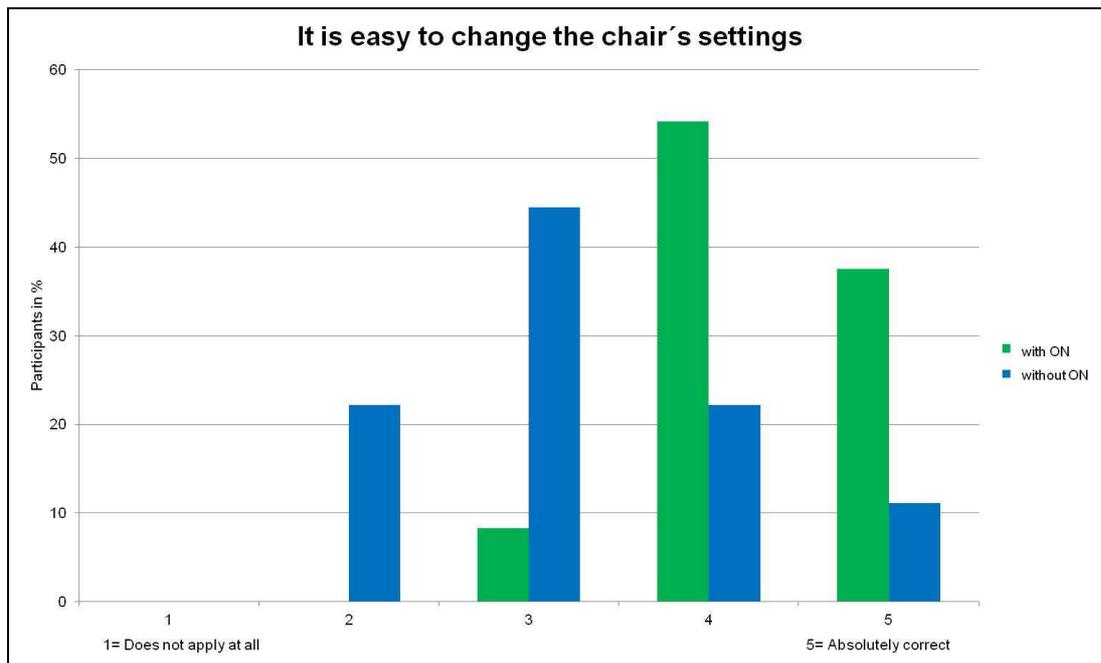


Fig. 10: results of the questions to all people taking part 12 weeks after the begin of the study on whether changes to settings on their office chairs were easy to make

The graph shows that only 8.33 per cent of ON users were undecided, whereas 91.67 per cent tended to, or indeed fully concurred. In the case of the control group on the other hand, two thirds of all people taking part gave the item a 2 or 3. This shows a fundamentally different tendency in assessing the item in the two groups. The median values of both groups vary significantly ($p=0.043$).

In the trial group it is at 4.2 (standard difference ± 0.7) and in the control group at 3.4 (standard difference ± 0.9).

Therefore, the people in the trial group find changing the settings to ON much simpler than the people in the control group do to their office chairs.

Furthermore, it was interesting to discover how often the chairs' settings had been changed after initial adjustments. The following graph shows the analysis of the "I change the setting of my office chair:" item:

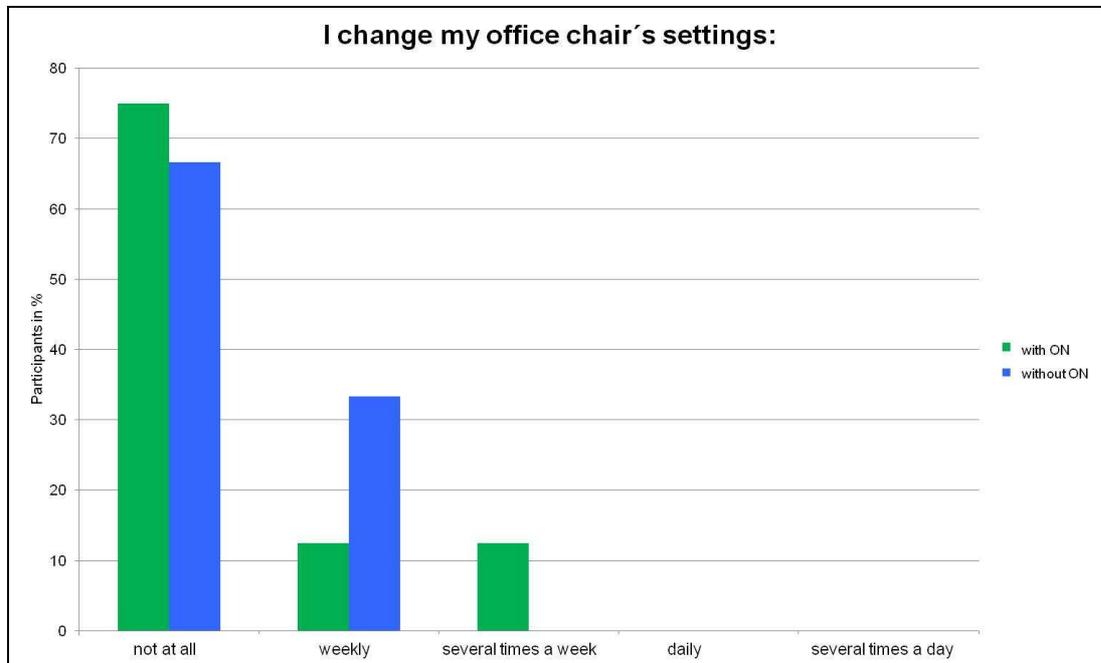


Fig. 11: results of the questions put to all people taking part 12 weeks after the test started as to how often they change the settings to their office chair

Both groups chose the "not at all" options most frequently. The median values of both groups are identical (trial group 4.6 [standard difference ± 0.7], control group 4.6 [standard difference ± 0.5]), so that there is no difference in how frequently settings are made between the test and control group. A clear majority (trial group 75 per cent, control group 65 per cent) does not change the settings while using the chair at all.

Questions were also asked about further aspects of the feeling of well-being on the office chairs concerned (for example functionality, quality and design). These aspects and the feeling of comfort jointly influence the feeling of well-being. Questions were specifically asked about this feeling of well-being before and after the study was completed. People taking part in the study are only included in the analytical statistics and results of the item entitled “I enjoy sitting on my office chair” if the initial and final questions include values from them [trial group n=25, control group n=8].



Fig. 12: results of questions to all test persons before and after the test as to whether they enjoy sitting on their current office chair. The median values and standard faults are shown.

When asked the initial questions the whole group produces a median value of 2.95 (standard difference ± 1.1) which is the same as the “neither nor” assessment. In comparison with the initial questions, the control group’s value that emerged from the final questions tended to be constant (3.25 [standard difference ± 1.1]) so we can assume the value is stagnating. In the trial group on the other hand a significant change is observed ($p=0.001$). The people taking part in the study give ON an average 4.1 rating (standard difference ± 1.2) which is substantially better than for their previous chair. The trial group feels much more comfortable sitting on ON.

Summary

The ON-related questions “I move about more with ON than before” and “I’ve discovered new movement thanks to ON and my range of movement is more varied” (figs. 4 and 5) verify that introducing more movement to sedentary office work has been successful. The majority of users have recognised the opportunity for new types of movement and clearly used these intuitively.

Most of the ON users admit that these specific movement options are good for their bodies, which is increasingly the case as the study progresses (fig. 6: “ON's more varied range of movement does my body good”). They also say that as a result their activities are supported (fig. 7: “I feel that ON allows me to work better”). Furthermore, the majority of the people taking part had already got used to ON and its special range of motion (fig. 9) and feel secure with the new movement options from the very beginning. The naturalness and simplicity of sitting is at the same time in full focus. ON has no time-consuming and complex settings. The people in the trial group find changing the settings to ON much simpler than people in the control group do with their office chairs (fig. 10). At the same time, the ON users believe ON's setting functions to be significantly better than those offered by their previous, conventional chairs. The fact that the office chair settings in both groups are hardly changed at all during use (fig. 11), underscores that the ON concept is on the right track. It aims to enable a change of posture and movement without altering the chair's settings (and mocks the commonly held belief that a range of setting options also have a huge impact).

The highly positive development of the trial group’s assessments of ON during the study and the answers given by both groups show that the trial group’s feeling of well-being does not just improve in relative, but in absolute terms too. This factor is confirmed by responses to the feeling of well-being on the office chair (fig. 12).

Conclusion

The results of previous research on the interaction of physical activity, subjective feeling of well-being and objective performance are borne out by this field study for office environments too. The test only covers the use of a new type of office chair. Trimension was used for the first time in the ON office chair. It is in particular the frequent and varied range of movement that it permits (occurring during the most minute shifts of weight) that a particularly stimulating, health- and performance-boosting effect is produced. In all three measurement parameters, the ON users' concentration performance developed extremely positively. It reaches a much higher level than in the control group with its conventional office chairs. In this case there is no relevant change over the course of the study.

A living organism is based on the principle of stimuli and response. As a result, recurring and varied movement stimuli in the office environment lead to better comfort and performance. ON's movement kinematics Trimension is clearly made use of in the office. It represents huge progress in dynamic seating. It is also an important component in an office environment concept that is as integrated as possible and which activates body and mind biologically. In other words, a three-dimensional, dynamic office chair that encourages varied and frequent movement while people are sitting down is good for the body and pays off.

Healthcare research also shows that a feeling of well-being and ability to perform can be boosted when further opportunities for more physical activity in the office are provided. Desks or lecterns with adjustable heights, materials and equipment positioned out of reach, or meeting rooms that attendees set up themselves (e.g. with mobile folding tables) are very good ways of adding physical activity to office work, for example by getting up, stretching or walking a few steps. Not just the body and the metabolism are given a boost, a few fresh new ideas might be produced too.