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## THE PROPHYLAXIS OF MUSCULOSKELETAL DISORDERS IN COMPUTER WORK ACTIVITIES

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### Abstract

**Aim.** The hypothesis of this paper was that modern technology can provide means of preventing musculoskeletal disorders, through desktop applications.

**Methods.** In this sense, two postural ergonomics applications are presented: *SitApp* and *Wellnomics*. By exploring the role of these applications in reducing the risk of postural dysfunction and of musculoskeletal disorders, an effective framework for monitoring and educating people about the importance of correct posture is provided.

**Results.** Benefits of *SitApp* application include:

- it is a free application;
- real-time alerts are sent to correct posture.

Strengths of *SitApp* application are:

- immediate feedback – for immediate posture correction;
- ease of use – it is an accessible application for anyone, regardless of the level of technological knowledge.

**Conclusions.** Active patient involvement in health management promotes long-term behavioral changes to improve health and wellbeing.

**Keywords:** computer work activities, musculoskeletal disorders, prophylaxis, desktop application, ergonomic work.

### Introduction

The technological evolution of the last decades has produced profound changes in the way people carry out their activities. Currently, technology allows activities to be carried out with increasing residential flexibility, but at the same time with a tendency towards sedentarism.

The use of the computer is almost indispensable in many fields of activity, from the activity of pupils and students to remote work (Jalali et al., 2024). Prolonged use of the computer, neglect of breaks and, often, incorrect positions at the desk can lead to the appearance of various musculoskeletal disorders (Demissie, Bayih & Demmelash, 2024; Wahlström, 2005).

Physical therapy has an important role in the treatment of various musculoskeletal disorders produced by computer work, but there is a growing need for preventive strategies to reduce the incidence of these disorders. A major challenge of the 21st century is the maintenance of postural health and the prevention of conditions determined by a sedentary lifestyle. In support of people who spend a long time in front of computer screens, in static positions, for various work activities, such as searching for information on the Internet by accessing websites, creating and editing text-type documents, spreadsheets and presentations, creation of written, audio or video content through different platforms, participation in courses and training through e-learning platforms etc., modern technology is coming, through the development of postural ergonomics applications (Destreza, Concepcion & Roxas, 2023), which help both from a prophylactic point of view, by educating users to adopt a correct posture during work, and from a therapeutic point of view, by adjusting the physical therapy treatment plan in depending on the patient's progress.

Postural ergonomics refers to the adaptation of the work environment and daily activities to maintain a correct and, implicitly, healthy posture (Chowdhury, Aghazadeh & Amini, 2017). Correct posture is essential for maintaining the overall health of the musculoskeletal system. When the body is properly aligned, pressure on the spine, joints and muscles is minimized, thus preventing the onset of disorders and discomfort (Lim, Basah, Ali & Fook, 2018).

Adopting an incorrect posture affects the body structure and, in the long term, this can lead to musculoskeletal problems (Chhabra & Mazhar, 2022; Montuori et al., 2023). For example, by adopting a position of leaning the trunk too far forward, a thoracic kyphosis can occur; by adopting a position with the back arched, into a hyperextended position, a lumbar lordosis can occur. These changes in the physiological curves of the spine can lead to muscle tension, spinal nerve compression and chronic pain.

Repetitive movements and incorrect use of the keyboard and of the mouse can cause carpal tunnel syndrome.

Lack of movement and adopting prolonged static positions lead to muscle fatigue and joint stiffness.

Of real use would be primary prophylaxis to prevent the occurrence of health problems, through the routine integration of desktop applications designed to monitor ergonomic work (involving adopting a correct position at the desk, taking breaks, doing exercises during breaks), providing real-time feedback and thus promoting a healthy way of

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working (<https://wellnomics.com/solutions/stretch-break-coaching-tool/>). If musculoskeletal disorders have occurred, the desktop applications can provide data regarding the patient's compliance to ergonomic practice recommendations, allowing the physical therapist to establish a plan to prevent complications of the conditions that have occurred and a treatment well adapted.

## Methods

The hypothesis of this paper was that modern technology can provide means of preventing musculoskeletal disorders, through desktop applications.

In this sense, two postural ergonomics applications are presented: *SitApp* and *Wellnomics*. By exploring the role of these applications in reducing the risk of postural dysfunction and of musculoskeletal disorders, an effective framework for monitoring and educating people about the importance of correct posture is provided (<https://sitapp.app/>; <https://i.unisa.edu.au/contentassets/05f8a2505c044c2b99b48b255bdc9b5e/wellnomics-app-guideline.pdf>).

In this paper, these applications are analyzed in terms of features, benefits and strengths to promote healthy ergonomic practice.

## Results and discussions

Postural ergonomics applications, such as *SitApp* and *Wellnomics*, have a key role in educating and monitoring correct posture in the work environment, but also in everyday life. These applications provide personalized directions, real-time alerts, periodic assessments of posture and physical activities.

Each application has its strengths, but used together they can provide a comprehensive solution for monitoring posture and improving health and, implicitly, wellbeing.

*Features of SitApp* application (<https://sitapp.app/>) include:

- *detection of an incorrect posture* – the application uses machine learning techniques to know the user's posture; through the web camera, the application monitors the posture, initially being recorded, using the *Posture calibration* function, the correct posture and the incorrect posture adopted by the computer user;
- *providing real-time feedback* – in this sense, the *SitApp* application provides real-time alerts by the appearance of a red eye in the upper corner of the screen, usually on the right side, when the user does not adopt a correct posture at the desk (Figure 1);
- *performing an analysis of the user's posture* – it tracks improvement in posture, progress over time, providing basic reports (Figure 2).

*Benefits of SitApp* application include:

- *it is a free application;*
- *real-time alerts are sent to correct posture.*

*Strengths of SitApp* application are:

- *immediate feedback* – for immediate posture correction;
- *ease of use* – it is an accessible application for anyone, regardless of the level of technological knowledge.

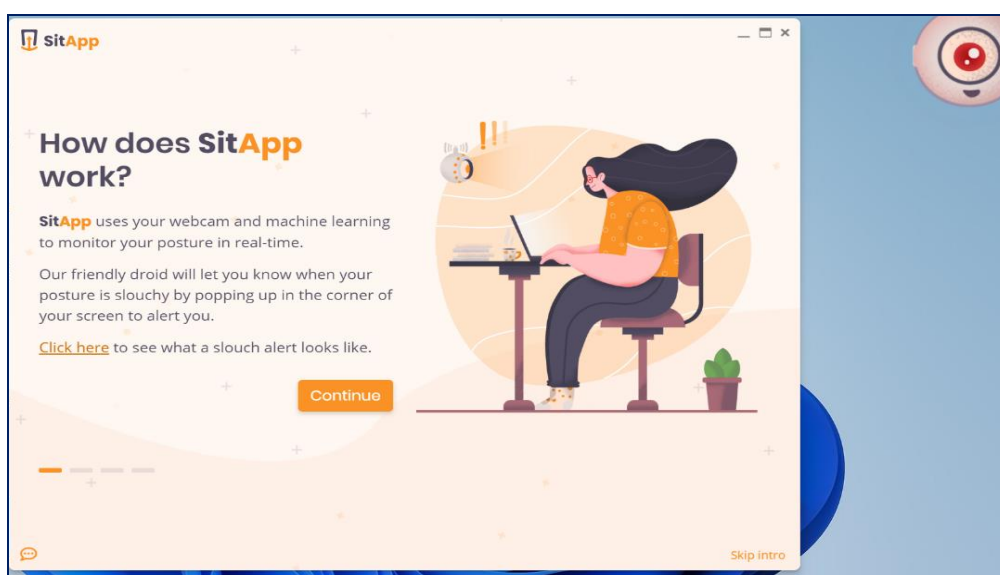


Figure 1. The alert provided by the SitApp application in case of an incorrect posture

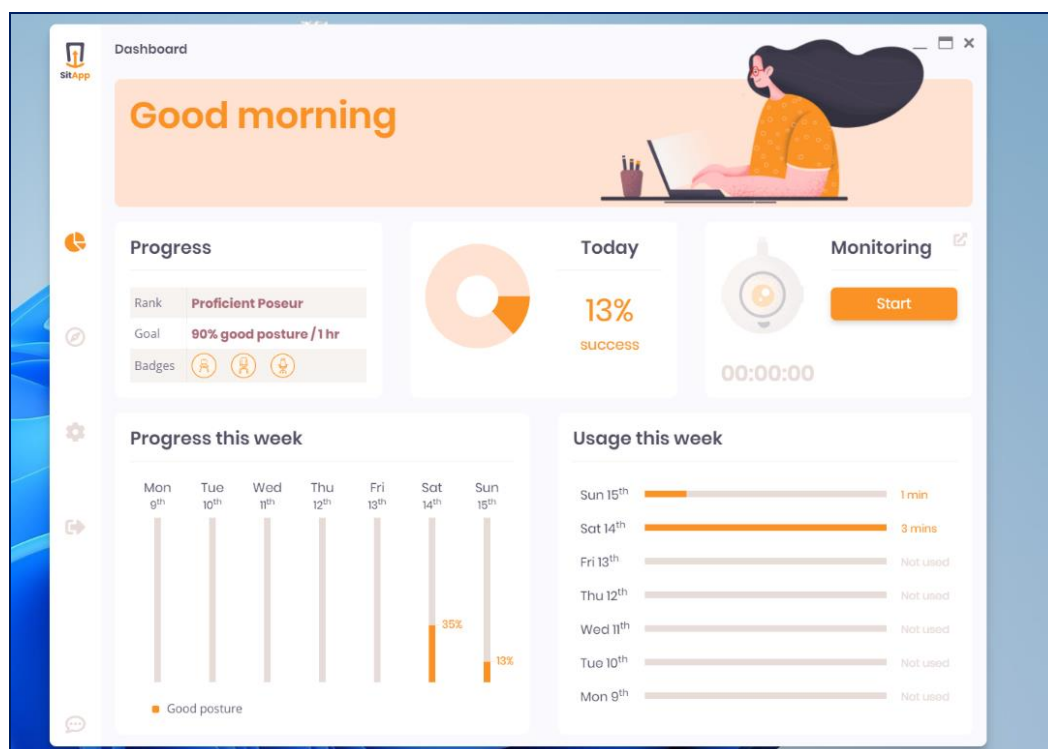


Figure 2. Basic report provided by the SitApp application with user posture analysis

For the **Wellnomics** application, the following main *features* can be mentioned (Wellnomics WorkPlace User's Guide, 2010):

- *automatic monitoring of activity on the computer* – the working time spent on the computer is tracked and usage patterns are identified;
- *warning for taking breaks and exercises* – on the screen is displayed in a small window (right - bottom) the time interval until the micro-break, the long break and the time of using the computer that day, according to the settings, which can be default settings (Figure 3) or customized by the user; during long breaks, exercises can be performed for different body areas, depending on the settings (Figure 4 – Figure 9);
- *personalized ergonomics* – the application provides ergonomic recommendations based on the user's activity and posture, regarding seat adjustments, monitor positioning, keyboard and mouse use;
- *detailed reporting and feedback* – providing reports on the user's work habit, statistics related to posture, movements performed during the day, as well as the level of wellbeing (Figure 10);
- *health risk assessment* – the application provides a risk profile in developing health problems such as musculoskeletal disorders, work-related and sedentary conditions;
- *training on improving posture* – the user is educated to adopt a correct posture and ergonomics in daily activity.

*Benefits of Wellnomics application include:*

- *reducing fatigue and preventing musculoskeletal disorders* – by promoting regular breaks and exercises during breaks;
- *promoting a correct posture* – ergonomic recommendations contribute to the prevention of back, neck, upper limbs and lower limbs pain;
- *continuous monitoring* – the application monitors and signals the taking of breaks, without the need for the user to remember this;
- *personalization of settings* – settings can be made according to the habits and work characteristics of each user.

*Strengths of Wellnomics application are:*

- *friendly and intuitive interface* – the application has an easy-to-use interface, offering recommendations that can be easily followed and integrated into the user's daily activity;
- *providing clear and easy-to-interpret reports* – through the reports provided by the application, users can better understand their work style and make the necessary adjustments.

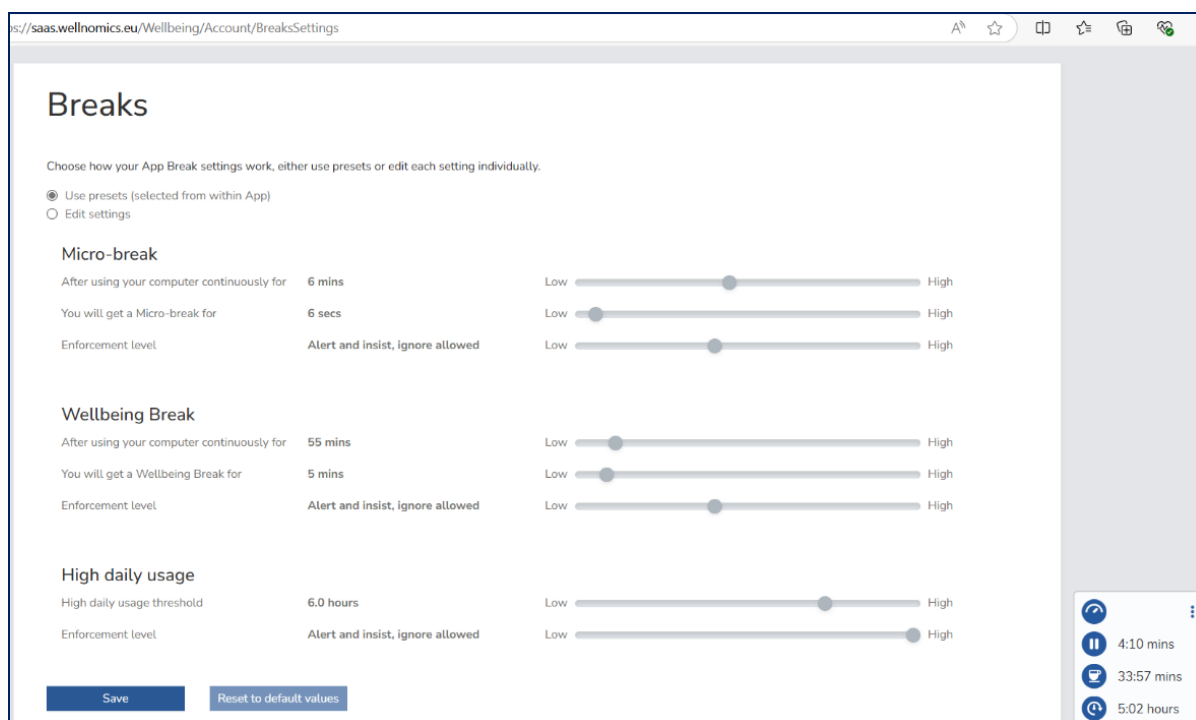


Figure 3. Indication of time available until breaks, depending on settings (Wellnomics application)

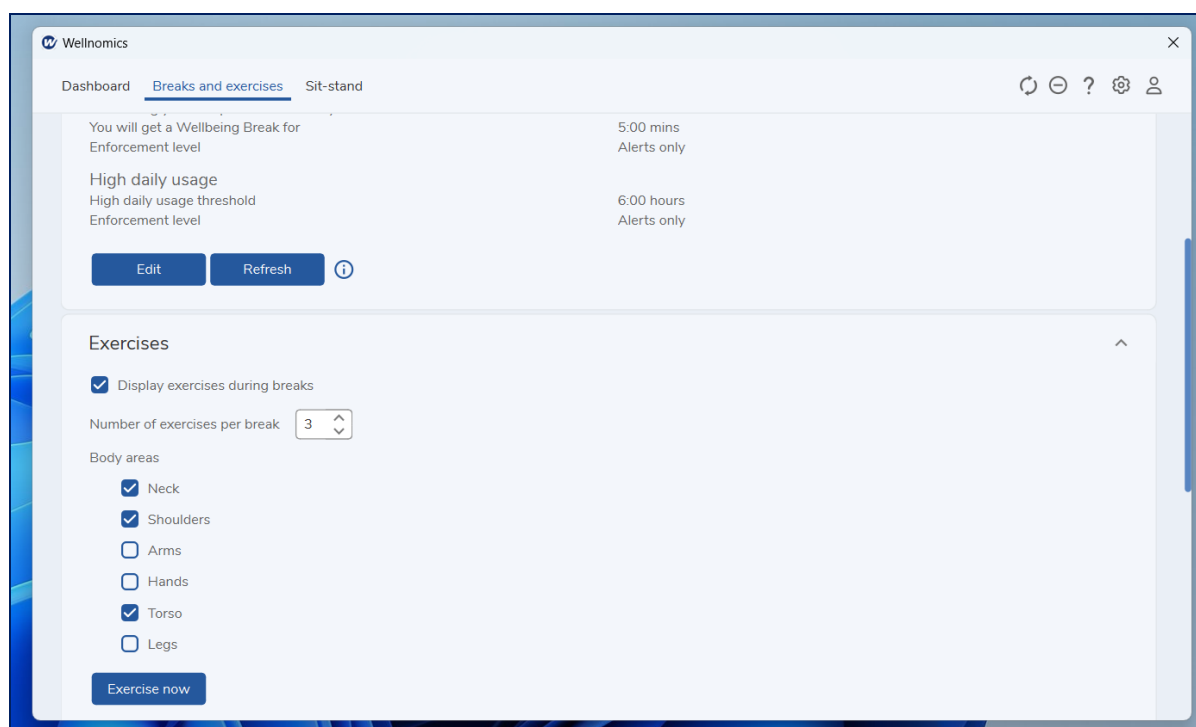


Figure 4. Setting the exercises to be performed during the breaks (Wellnomics application)

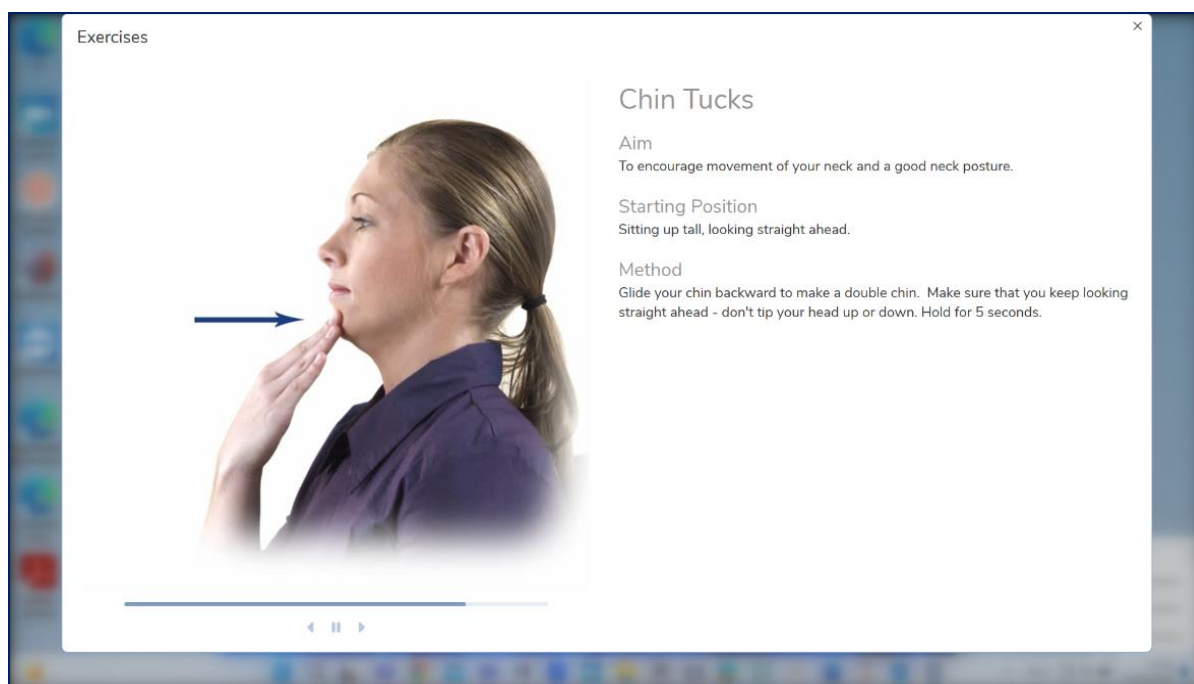


Figure 5. Chin Tucks Exercise (Wellnomics application)

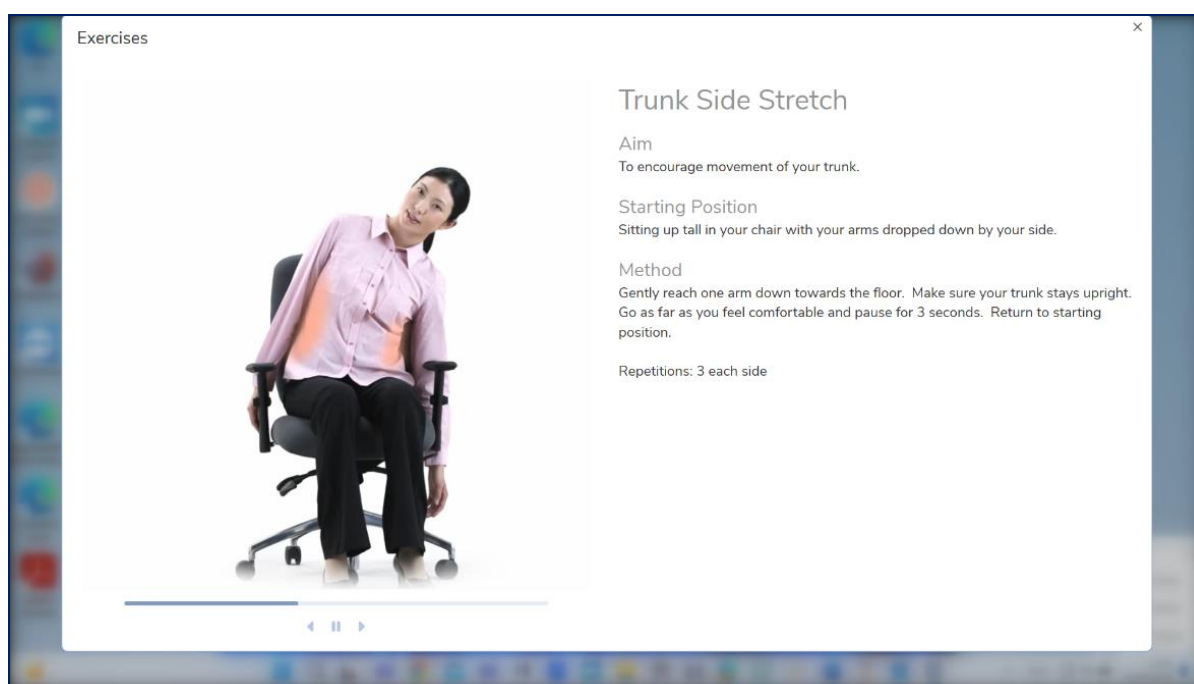


Figure 6. Trunk Side Stretch Exercise (Wellnomics application)



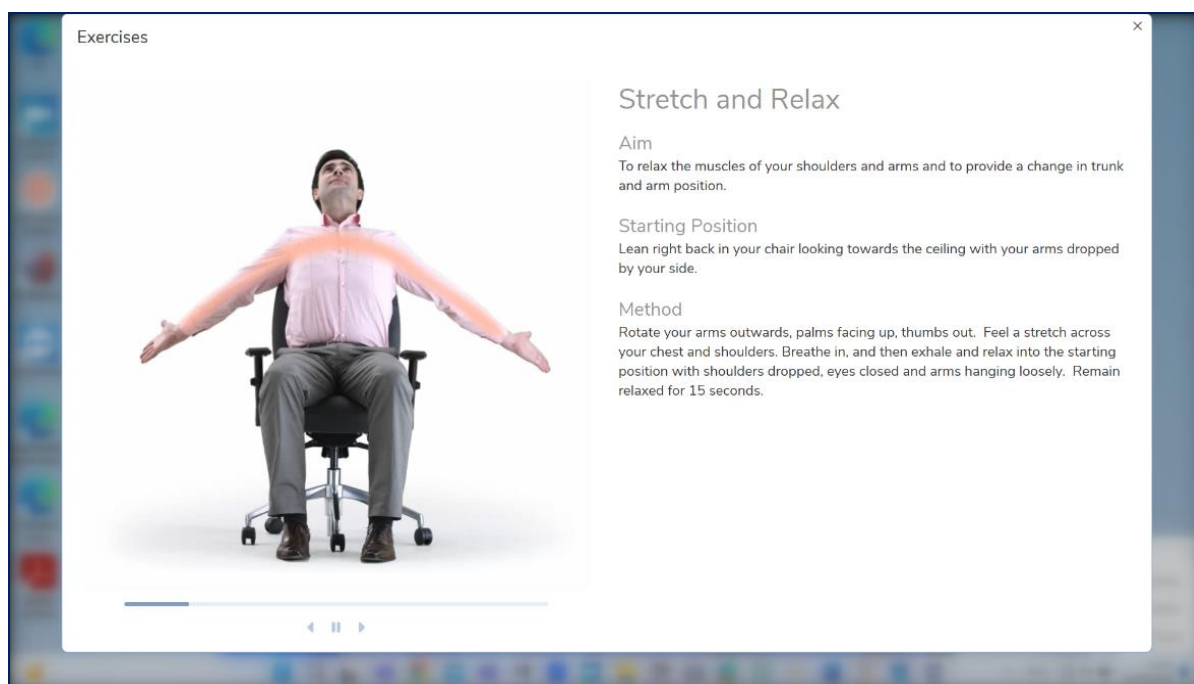


Figure 7. Stretch and Relax Exercise - frontal view (Wellnomics application)

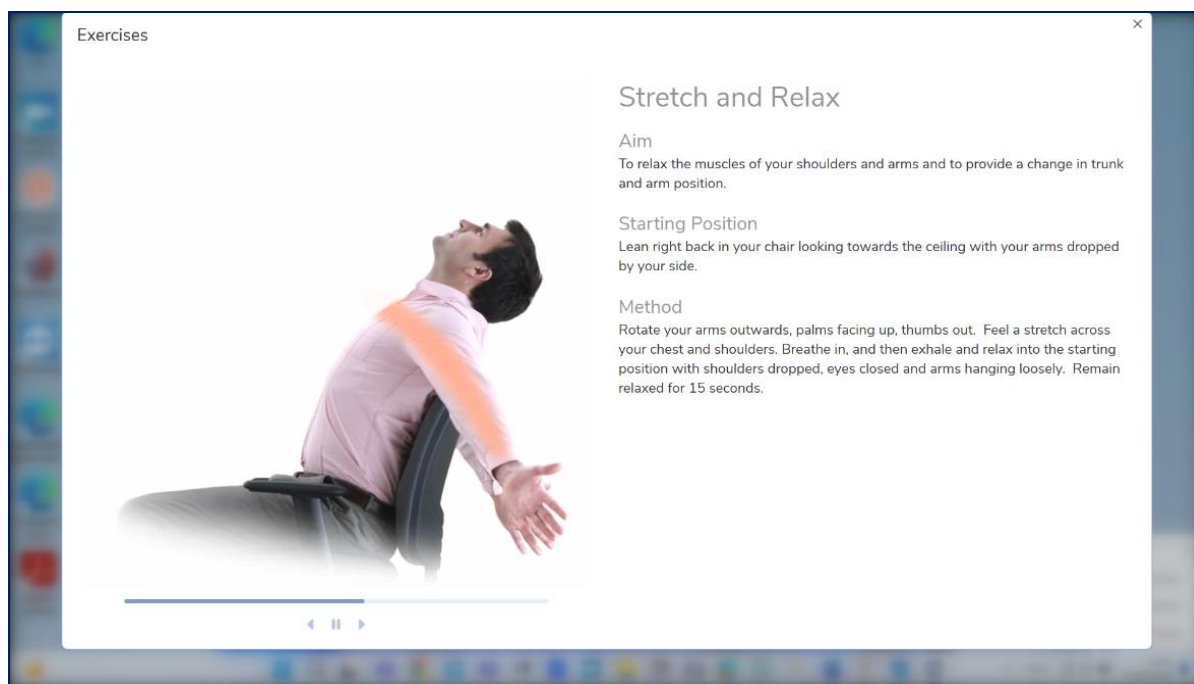


Figure 8. Stretch and Relax Exercise - lateral view (Wellnomics application)



Figure 9. Leg Stretch Exercise (Wellnomics application)

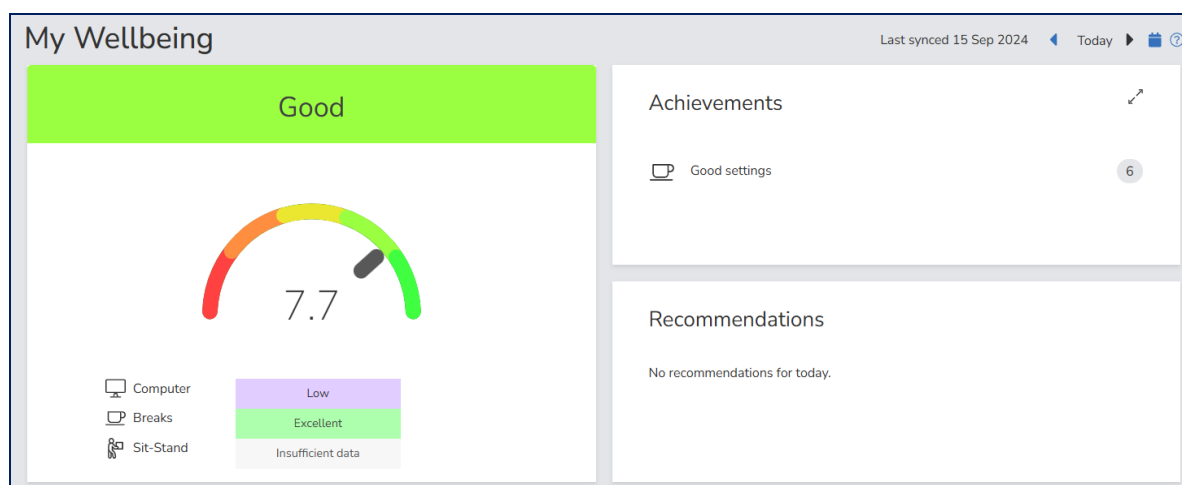


Figure 10. Report on the level of wellbeing of the user (Wellnomics application)

*SitApp* and *Wellnomics* desktop applications have their own features, benefits and strengths, but used together for posture monitoring, they can provide both a detailed analysis of specific issues related to the work environment and real-time corrective feedback.

These applications complement each other, offering a comprehensive solution especially in the prophylaxis, but also in the therapy of musculoskeletal disorders. The *Wellnomics* application provides ergonomic assessments of the computer user's work environment, his sitting posture, repetitive movements, data that helps identify long-term health risks. The *SitApp* application provides real-time feedback when poor posture is detected, providing immediate alerts to correct it. By integrating the two applications, a personalized monitoring plan can be created. Through the *SitApp* application, postural correction is tracked throughout the day, and through the *Wellnomics* application, it is possible to track compliance with breaks and exercise during breaks, as well as observing long-term data, providing information to optimize the therapeutic plan, supporting a style of balanced life. The *SitApp* application monitors the user's progress over time on improving posture by providing basic reports.

## Conclusions

Through the integrative use of postural ergonomics applications, such as *SitApp* and *Wellnomics*, a holistic approach can be taken to support long-term health by promoting good ergonomic workplace practices for computer users. Active patient involvement in health management promotes long-term behavioral changes to improve health and wellbeing.

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