Design and Technology: evaluation of working postures of manicurists with a full-body measurement system based on inertial sensors

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The aesthetics market grows ever faster. The activities exercised by manicurists and pedicurists is not limited to aesthetic nature, once it was related with health, hygiene and diseases prevention. However, the worker who is involved in this activity complains about musculoskeletal disorders caused by postures, long working hours, repetitive movements and inappropriate furniture. It is therefore necessary to develop more studies on this subject (MASSAMBINI, 2011; MACHADO et al., 2010). In this activity, workers keep their upper limbs in awkward positions. In addition, the work is done, most of the time, in the sitting position on low chairs, situations that require intense physical effort. (Figura 1). Thus, this paper aims to evaluating the working postures of manicurists with a full-body measurement system based on inertial sensors.

![Figura 1: Posture adopted for manicurists activities. Source: The authors.](image)

This study was performed at a Beauty Center in the City of Florianópolis, in the South of Brazil. The Beauty Center has a team with six professional staff, being one make-up artist, two hairdresser, and three manicurists and pedicurists. The scope of this paper focuses on manicurists activities. Hence, the present study evaluated three manicurists and pedicurists, among which one has had her movements evaluated. The workers signed an informed consent form that explained the aims and stages of the research.

This research has three stages. The first stage covered the literature review, with an emphasis on physical consequences associated with the aesthetics market. The second stage comprised the field visits, in which have been applied research tools such as socio economics questionnaire, body map questionnaire, body measurement system based on inertial sensors, photography and filming recording. The body measurement took place at Xsens MVN Biomech. In the last stage, the data analysis occurred on Xsens MVN Studio Pro for subsequent analysis according to the body map questionnaire and the literature review.
The Xsens MVN Biomech is a body measurement system based on 17 inertial sensors that tracks the body segments, its orientation, position, and motion (Figura 3). The system operates in real time in the frequency 120 Hz. The data is transmitted to a computer by Wireless. The software generates graphics about the joints angles, speed and length of movements, and allows to watch, recording, and analyse the body movements. The equipment operates in all types of environment and terrain (ROETENBERG; LUIJING; SLYCKE, 2013).

Results indicate a work situation in need of modification to avoid health damage to the manicurists. The questionnaire proves that on the last seven days the manicurist had pain on the right side of the body (Figura 4). It is worth highlighting that the main health problems found are associated with neck and back. This assessment coincides with the complaint of the manicurists.
More specifically, concerning a analysis based on each body part to identify the main health risks, it can be observed that the neck and back may be considered the more critical situations during the customer service. The manicurist does not use tools to enlarge the view of the nails, so it is necessary the closest approach of visual field to perform the work. Additionally is demonstrated the damages of the arms, forearms, and wrist (Figura 5).

As seen in the Figure 5, the manicurist keeps the C1 cervical vertebra flexed approximately 20° (blue line). In addition, the neck and back are flexed, which increase the strain on the body. It is possible to observe that the manicurist makes a neck lateral rotation too (red line), this movement is frequently repeated when the manicurist needs to change the tools. The neck flexion is kept during the lateral rotation. With regard to axial rotation (green line), the movement is not often performed. According to Machado et al. (2010), this routine work situation is liable to cause serious musculoskeletal damage that interfere in daily activities at home and at work.

The major difference between manicurists and pedicurists activities may be observed on the superior neck and back flexion. Thus, the continuation of this research intends to investigate the activities of pedicurists.
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References


