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Relationship between postural reeducation technique during sleep and relaxation technique in sleep quality

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Abstract

The common sense warn that the quality of our day depends on the quality of our previous night. Among the main factors contributing to a better sleep quality is the postural behavior during the sleep period. However, little or nothing is known about the actual influence of these behaviors on people sleep quality. This paper presents a study which aims to: i) Check if people can take on a new postural behavior during the sleep period after a training period aware of this behavior and; ii) Check if a postural recommendations can aims to induce positive changes in the perception on the indices of Sleep quality in young adults, according to ecological and environmental approach. A sample of 21560 observations, which corresponds to 595 hours of sleep hours of 24 young adults, 12 male military and 12 female undergraduate, participated in this study. The Pittsburgh Sleep Quality Index (PSQI) was used to measure the perception of sleep quality before and after six consecutive months of appliance of the Postural Intervention program. Results shown that the Postural reeducation group improved self-perception of sleep quality (from bad to good) and a significant difference between the periods of the study ($p = 0.008$), according to the Student's T-Test and, ideal posture while sleeping using the ideal placement and amount of pillows (1.34% to 81.48%). Findings of this study allow us to suggest to health care professionals, in particular the rehabilitation professionals, new strategies and solutions for ergonomic change in posture in bed and improve the sleep quality indices.

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Keywords: Sleeping posture position; Postural intervention; Health care professionals procedures; ISEE; Pittsburg Sleep Quality Index.

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1. Introduction

Circadian rhythms, that is one of several biological rhythms found in humans, are produced jointly by the action of various structures of the nervous system and are influenced by various environmental factors, and also by sleep quality [1, 2]. The common sense warn that the quality of our day depends on the quality of our previous night. Among the main factors contributing to a better sleep quality is the postural behaviour during the sleep period. However, little or nothing is known about the actual influence of these behaviours on people sleep quality. Human health may have several problems that occur when sleep disturbances are verified, causing loss in the sleep quality, autonomic dysfunction and decreased professional or academic performance [2, 1, 3]. This disruption of the normal circadian rhythm can result in fatigue, poor sleep quality, and degraded performance, gastrointestinal upset, and negative mood. Circadian disruption, occurs when there is desynchronization between external time clues (e.g., sunlight, meal times, work schedules) and the internal physiologic clock, which regulates sleep–wake cycles, digestion, body temperature, cardiovascular function, renal function, and the release of certain hormones (e.g., prolactin, growth hormone, androgens, cortisol, insulin) [4, 5].

The non-pharmacological therapies, such as behavioral therapy (e.g. relaxation technics), produce reliable and durable changes in several sleep parameters of chronic sleep disruption sufferers [6, 7].

Interventions based on relaxation were established from the observation that, often, patients with sleep disorders report a high state of alert (physiological and cognitive), both at night and during the day. One of the most common types of relaxation is progressive muscle relaxation, which consists of different intends and relax muscle groups around the body towards a decrease in the physiological alert (muscular tension) to improve sleep [8, 9].

Demiralp, Oflaz, & Komurcu [10] states that the Progressive muscle relaxation training is a promising approach in ameliorating the sleep quality, Progressive muscle relaxation aims to reduce somatic arousal. Behavioral therapy aims to change maladaptive sleep habits, reduce autonomic arousal, and alter dysfunctional belief and attitudes that can perpetuate sleep disorders [11, 7].

The behavioral and postural habits and sleep rhythm of young adults change depending on the specialty work or period of study or other types of events but we did not find anything in the literature to analyze and evaluate this behavior through sleep disorders. Perhaps this is related to the fact that the evaluation of this behavior is complex and the observation of these postural behaviors in the environmental context is needed. However the observation methodology based on iSEE software [12] in the context of sleep period [3] allows the classification and registration of postural behaviors for long periods of time and can be applied in this context.

Therefore, taking this into consideration, the use of video analysis increases the capability to collect more detailed information on human activity during the interaction of the user with a product-environment system [13].

Video analysis has shown a great efficiency in revealing behaviors in which is difficult to quantify the interaction in real (non-laboratory) environment, using more extensive samples of time that can reveal phenomena not visible in other analysis techniques [14, 15, 13].

In a general way, the data regarding the sleep analysis is collected in simulated laboratory conditions and they have some advantage such as: an accurate control of variables, a high potential to collect physiological measures and the accuracy of data collected, mainly the quantitative data but, although these kinds of studies interfere with the tasks and with the natural behaviors in the sleep period [16, 17].

Hendrick and Kleiner [18] argue that the main element for a good ergonomic analysis of the activity is to adopt a systemic approach of activity through the analysis of all possibilities of interactions in a real context.

Usually, researchers combine some objective with subjective techniques, which generally are qualitative, such as questionnaires, interviews and direct/indirect activity observation, in order to minimize the difficulty in applying these Postural reeducation methods or these relaxation technique in real context [12, 19, 20, 21].

In this context, the main objectives of this study are i) Check if people can take on a new postural behavior during the sleep period after a training period aware of this behavior and; ii) Check if a postural or relaxation technique recommendations can aims to induce positive changes in the perception on the indices of Sleep quality in young adults and; iii) analysing which technique (or postural relaxation) that could allow an improvement in the quality of sleep, according to ecological and environmental approach. This knowledge will allow to: a) understand the possible changes of indices of sleep quality referred by participants in the day-by-day activities; and, b) elaborate more specific recommendations to the changes in postural behaviors or introduced the relaxation technique.

For this paper we will present the results for interaction patterns during the use of a set of specific Interaction Category - IC, according to the methodology and tool to measure postural behavior during sleep (8 hours/night), proposed by Desouzart, Filgueiras, Melo, & Matos (2014), which were acquired as part of a larger ongoing study related to the perception of Back Pain, Sleep quality and Quality of life with the observation of sleeping position during the night period (8 hours/night).

2. Methodology

This study started on the 9th of April 2013 and finished on the 14th of February 2014, and use a methodology proposed by Desouzart, Filgueiras, Melo, & Matos [22].

This study was made considering a mixed-tools approach, using questionnaires and observation methods through video analysis, to straight forward the methodology and produce robust results.

Data was collected from 24 young adults aged between 18 and 25 years old (Mean=20.96 +1.899) of the Portuguese air force military and Portuguese university. Twelve male soldiers, of different categories (1st Corporal, 2nd Corporal or Soldier) and twelve female university students, studying in the healthcare domain (physiotherapy, occupational therapy, speech therapy, nursing and dietary therapy), residing in dormitories of the air base and the university were selected. Each participant will be approximately six (6) months with two months of personal contact between the principal investigator and volunteers, and the remaining time implying an impersonal touch through e-mails and mobile phone.

2.1 The subjects and night activities

At the beginning, 89 students (21 male and 68 female) belonged to the Polytechnic Institute of Leiria of Portugal, aged between 17 and 30 years, residing in dormitories answered a questionnaire about the perception of sleep quality according to the Pittsburgh Sleep Quality Index (PSQI) and 12 female (mean=19.75 years old + 1.138), studying in the healthcare domain were volunteers in this study. On the other hand, 66 soldiers (54 male and 12 female), aged between 18 and 25 years, and belonged to the air base n. 5 of the Portuguese air force when the research began. These, answered a questionnaire about the perception of sleep quality according to the Pittsburgh Sleep Quality Index (PSQI) and, 12 male (mean=22.17 years old +1.749) were volunteers in this study.

Participants were informed about the study's objective and procedures through a group meeting and an individual approach on the day before each video recording but, did not inform what ergonomic recommendation can be reveals at the end of study in each group. Finally, participants were instructed to perform their tasks as usual and to not change their schedule due to the presence of the cameras. All video collection was authorized by the participants through a consent form and all procedures in this project is in line with national and international guidelines for scientific research involving human subjects, and including the Declaration of Helsinki in 2013 on Ethical Principles for Medical Research Involving Human Subjects, and the 1997 Convention on Human Rights and Biomedicine (the "Oviedo Convention"). The ethics committee of the Faculty of Human Kinetics, University of Lisbon approved the Postural reeducation procedures with No. 13/2014.

2.2 Recording Procedure and Features

The participants' interactions with the bedroom equipment were video recorded on a normal rest period day and were assessed using: a) one infrared digital camera (Wireless AEE Weather-proof - 2,5 GHz – color); b) one multiplexer video recorder (ACH MPEG-4 Realtime DVR) and c) DVD recorder HD (LG recorder). All devices' lights were turned off or hidden and participants were informed about the placement of all cameras. However, they did not know the real video recording time. All participants were informed that the cameras filming at random, being the day of capture undefined images to generate the surprise effect and maintain the usual behavior during the recording period. Each participant could block the camera, preventing the capture of images, on the night that he did not want to be filmed, as could also request deletion of the recording of the previous night. No participant blocked the camera or requested the deletion of filming. The digital video cameras turned on automatically from 12:00 p.m.

to 8:00 a.m. and during the periods in which the subjects were asleep, awake, out of bed, doing activities, using a pillow. The data, collected through video using a methodology proposed by Rebelo, Filgueiras & Soares [13], analyzed the postural behavior in real situations in bed and was done using software developed for this purpose. The fundamental aspect of this analysis using the software iSEE was: a) evaluate the behaviors of interaction in a real environment and for long periods of time; b) Allow sorting at the same event an impossible number of observable in other techniques; c) Observe activities, actions, means of interaction (equipment) and postural behavior in the same event. Following of the analysis of the results of the previous phases and of the observation of the collected videos, the categories were defined. Two (2) categories of behaviors were defined, that represent the night activity (Level 1) or posture behaviors (Level 2) in this residences' bedrooms and one other non-specific category (Fig 1).

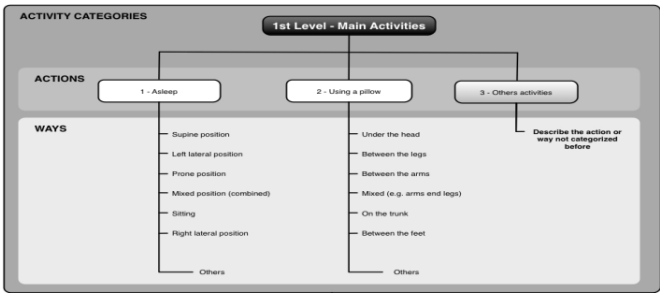


Fig. 1. Comparison between the 1st and the 2nd phases for postural behavior during sleep in each Group

2.3 Postural reeducation study

A sample of 27840 observations, which corresponds to 768 hours of video analyze and 595 hours of sleep hours (n=21560) of 24 young adults (mean age=20.96 + 1.899) participated in this study, were classified into two (2) Interaction Categories (IC´s) with observation method (iSEE). The individuals were separated in 3 groups: a) Postural reeducation Group (PRG), b) Relaxation technique Group (RTG) and c) Control Group (CG). Individuals in the Postural reeducation Group (PRG) were instructed regarding the method used in this study, which represents the recommendations of the ideal sleeping posture with the optimal quantity and place of use of pillows according to the pathological problems (Intervention program). Was indicated by an initial lecture and weekly positive reinforcement (with sending the material presented and informal contact through e-mail and phone), participants in Group I - PRG, altered the initial body posture while sleeping to: i - The lateral decubitus right or left, with a pillow in the head / neck height of the distance between the shoulder and the neck of each participant, a pillow between the knees and a pillow between your arms or; ii - The Supine, with a low pillow (5 cm) below the head / neck and a pillow or high roller (15cm height) below the knees. These positions have been indicated in order to keep a good balance and alignment of the spine and distribute the body's weight over the entire surface of the mattress [23, 1, 24]. These indications will be held every day for the duration of this study, which provided a continuous reinforcement of the method through informal contact via email and mobile phone for any questions and issues. Individuals in the Relaxation technique Group (RTG) were instructed regarding the method used in this study, which represents the recommendations of the relaxation technique, for participants perform the technique of progressive muscle relaxation of Jacobson before going to bed to sleep [25, 26], later designated Group II - RTG. These indications will be held every day for the duration of this study, which provided a continuous reinforcement of the method through informal contact via email and mobile phone for any questions and issues. With the third group will be held only a moment's interview with an indication of future surveys, subsequently appointed Group III - CG.

2.3.1 Procedures

These groups should apply or not changes in sleeping posture or relaxation technique during three (3) consecutive months per each participant.

In the first week, some questionnaires were carried out: a) the questionnaires of personal identification and; b) measurement of sleep quality at the moment of the response to the questionnaire. From second week to 2nd month, all 24 participants have been filmed during 3 consecutive days, with only two days to capture images to verify the initial behaviour of all participants. In the 2nd month, the individuals selected for the PRG were given the recommendations and indications of the ideal sleeping position, as well as the ideal quantity, height and place for the positioning of the pillow when sleeping. The individuals selected for the RTG were given the recommendations and indications of the technique of progressive muscle relaxation of Jacobson. In the 3rd and 4th months, the participants of PRG and RTG groups were contacted to ask if the signs were being applied, whether there were any doubts about the recommendations and for reinforcing these indications. At the end, in the 5th and 6th month, all subjects were re-filmed to analyse whether recommended changes were implemented.

For the carrying out of this study, the PSQI was used to measure the intensity on the sleep quality [27] before and after six consecutive month an Intervention ergonomic program.

All data were coded and computerized with statistical analysis performed using Statistical Package for the Social Sciences (SPSS), version 20.0. Independent T-test for parametric statistics were used (comparing the same group at different times), setting the level of significance at $p \leq .05$.

3. Results

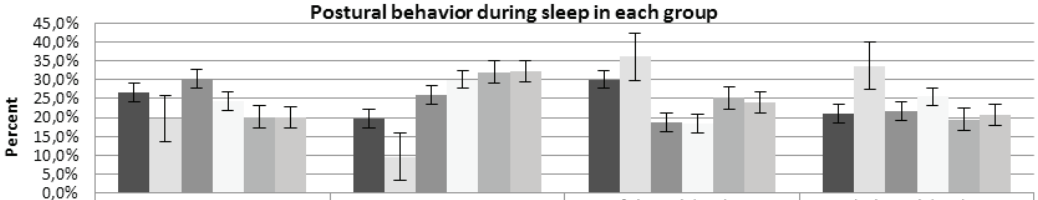
In the first phase, a sample of 13920 observations, which corresponds to 384 hours of video analyze and 294 hours of sleep hours (n=10670). The data of sleeping position presented higher incidence of supine, and this as the most common postural behavior during sleep with 25.9% (n=2754), followed by the prone posture with 25.7% (n=2729), left lateral position with 24.6% (n=2619) and right lateral position with 20.8% (n=2212). The other types of posture observation (mixed or at movement) in these analyses has 2.9% (n=317). The results show that 93.89% (n=11545) of the participants used only one pillow under their head, followed by used a pillow under the trunk with 2.67% (n=328) and, in the mixed position with 1.89% (n=233).

After of analyses the postural behavior during sleep, the second analyze in this study was the indications on perception of sleep quality according to questionnaire PSQI. Representation of 7 PSQI components allows to analyze the overall quality of sleep of 24 participants in the 1st period and the 2nd period. Each component is assigned a score of 0 to 3, with 0 being the very good sleep and 3 very bad sleep, where a total equal to or less than 5 points means a good quality sleep and greater than 5 values represents a bad quality sleep .

A global analysis of the sleep quality questionnaire responses showed a prevalence of self-perceived sleep quality as being BAD with 6 point, on the first image capture period (Fig. 3). When comparing the results of the 2nd period and compared with the results presented above, these showed: In the second phase, a sample also was 13920 observations, which corresponds to 384 sleep-hours. The data of sleeping position presented higher incidence of right lateral position, and this as the most common postural behavior during sleep with 27.1% (n=2950), followed by the left lateral position with 26.6% (n=2889), than prone posture with 23.1% (n=2521) and supine posture with 21.4% (n=2333). The other types of posture observation (mixed or at movement) in these analyses has less observation, with 1.8% (n=195). The category Using a pillow showed in the second phase of the participants a lower incidence of use of the pillow under his head compared to the 1st phase, with 59.60% (n=8028), followed by references that grew compared to Phase 1, which is using a pillow in the mixed position (under the head + between the legs + between the arms), with 35.05% (n=4692) and than, used a pillow under the trunk with 5.35% (n=761).

As described in the methodology, participants were separated into three groups (Postural reeducation, Relaxation technique and control), to verify that the ergonomic recommendation may improve indices of quality of life in young adults. The results that follow shows the comparison between the 1st and 2nd phases of each group in order to analyze all the data, and check whether there was any difference between the phases and between groups. The analysis concerns the posture while sleeping in the Postural reeducation group (N=4640) presented significant difference (p=.000) between the 1st and 2nd phases. The first analysis concerns the posture while sleeping in the Relaxation technique group (N=4640) presented significant difference (p=.009) between the 1st and 2nd phases. The analysis concerns the posture while sleeping, where the Control group (N=4640) presented no significant difference (p=.488) between the 1st and 2nd phases (Figure 2). The comparison of category Using a pillow between the first

and the second phases showed in the each group: i) The Postural reeducation group showed in the 1st period higher incidence of use of the pillow under the head with 92.52% (n=3802, 2nd phase was 3rd with 2.27%, n=103). The main change behavior in the use of pillows occurs in this Postural reeducation group, where participants used with the highest incidence in the pillow in the mixed position with 95.06% (n=4433) in the 2nd period, after ergonomic intervention; ii) The Relaxation technique group showed in the both periods higher incidence of use of the pillow under the head with 97.72% (n=4236) and 86.93% (n=3955) and; iii) The Control group showed in the both periods higher incidence of use of the pillow under the head with 90.81% (n=3504) and 93.45 (n=3970).



	Supine	Prone	Left lateral decubitus	right lateral decubitus
1st PRG	26,7%	19,6%	30,1%	21,0%
2nd PRG	19,7%	9,5%	36,2%	33,7%
1st RTG	30,2%	26,0%	18,8%	21,7%
2nd RTG	24,4%	30,1%	18,3%	25,5%
1st CG	20,1%	32,1%	25,2%	19,5%
2nd CG	20,1%	32,2%	24,0%	20,6%

Fig. 2. Comparison between the 1st and the 2nd phases for postural behavior during sleep in each Group

Regarding the indications of sleep quality in the 2nd period using the same questionnaire (PSQI), they showed a slight improvement over the 1st period, totaling 5 points in self-rated sleep quality as being GOOD at the end of the study. To check which allowed the amendment of a poor quality sleep for a good quality of sleep, it is important to analyze groups (Postural reeducation, Relaxation technique and Control) and check if this improves the sleep quality score was linear in all groups or the improvement of a single group allowed an overall improvement between study periods. For this we will present the overall result of the 7 components of the PSQI. The Postural reeducation group (PRG) showed in the 1st period in the set of values, a total of 6 points, which means a bad quality sleep. When the values reported in the 2nd Period, his was an improvement over the 1st period, totaling 3 values, which is a good quality sleep at the end of the study and a significant difference between the phases ($p = 0.008$). The results of the 7 components of PSQI in the Relaxation technique group (RTG) showed that at baseline (1st Period), participants showed a good quality of sleep (4 values), but these data changed to decreased quality of sleep, standing in the 2nd period on 6 values, which is a poor quality sleep, this group presented an inversely significant difference ($p = 0.018$), as this difference is a worsening in sleep quality. The control group has a reference Good sleep quality in the 2 periods (5 and 4 points, respectively 1st and 2nd period) but no significant difference between the phases ($p = 0.273$). Comparison of the results from the first to the second stage is shown in figure 3.

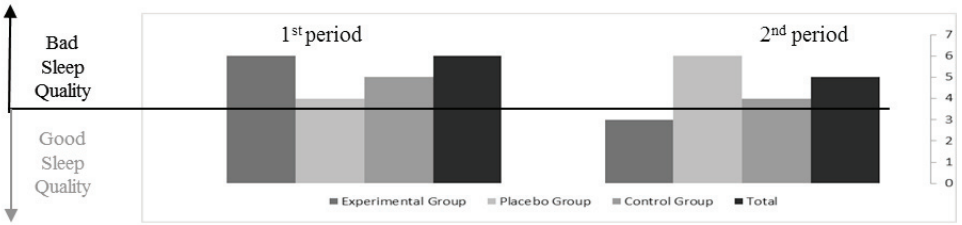


Fig. 3 - PSQI per group and total

4. Discussion

The indications provided to the participants were related to having a recommended posture in the sleeping position, taking into account the loads and forces that influence the human body at all moments in life. The results could prove the first mean objective of the study, in which we wanted to check if there is any change behaviour in

the postural behavior during sleep and use of pillows occurs in this Postural re-education group, where participants change the initial sleeping position for lateral decubitus (left or right) and used the pillow with a higher incidence in mixed position as indications of ergonomic intervention. The results could prove the second mean objective of the study, in which we wanted to check if there is any influence on the indices of sleep quality in young adults self-reporter during day activity, especially when performed a program of ergonomic recommendation using postural behaviors during sleep in the residences' bedrooms, according to ecological and environmental approach. Regarding the participants of the Postural re-education Group, as previously stated, indicated a significant higher incidence of levels of PSQI with 3 values which represents a GOOD sleep quality after 6 consecutive month ($p= 0.008$) of ergonomic intervention, which enables the validation of the hypothesis proposed in the beginning of the study but, did not prove the hypothesis of the participants of the relaxation technique group, as previously stated, indicated a significant lower incidence of levels of PSQI with 2 values which represents an inversely significant difference ($p = 0.018$) and a BAD sleep quality.

5. Conclusion

The influence of the sleep position on the physiological damage in the rest of the period with or without activities in bed is not very known [28]. The results obtained with this method of Ergonomic recommendation using an analysis of postural behaviors for long periods of continuous time are important to understand their influence on musculoskeletal conditions and on sleep quality. This data can be associated to the increase of the musculoskeletal problems, which can be found among young adults when these remain in bad postures for long periods of time in bed.

While held image capture, participants answered a questionnaire about the perception of sleep quality according to the Pittsburgh Sleep Quality Index (PSQI). The questionnaire´s result showed: GOOD sleep quality reference in young adults; a global analysis of the PSQI showed a prevalence of self-perceived of sleep quality as being GOOD in the second period in compare to first period (BAD sleep quality).

The biggest result of this study can be seen in the group receiving ergonomic recommendation (Postural reeducation group) compared to the group that received the indicating relaxation technique and the group that received no indication. The Postural reeducation group improved self-perception of sleep quality (good for bad) and posture while sleeping (51.1% to 69.9%) using the ideal placement and amount of pillows (2.41% to 95.06%).

These results show that ergonomic recommendation was effective and was better than the relaxation technique on self-perception of sleep quality in young adults, since the observable behaviors according to video analysis demonstrate the proposed changes to the method of motor behavior during sleep.

Finally, this iSEE methodology was considered efficient for the proposed objectives and the findings suggest new challenges for future research. Findings of this study allow suggesting what graphical interface designers must seek as new strategies and solutions for behavior change in posture in bed, exploring other peripheral equipment for sleep position; or, at least, to improve the posture of the participants when using the number and the ideal placement of pillows in the bed and if these Ergonomic changes can influence the reduction in quality of life indications.

However, the iSEE software methodology defines the categories of observation, called categories of interactions, and the software to quantify them [12].

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