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Effects of an adapted mattress in musculoskeletal pain and sleep quality in institutionalized elders

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ABSTRACT

We aimed to evaluate the impact in sleep quality and musculoskeletal pain of a Medium-Firm Mattress (MFM), and their relationship with objective sleep parameters in a group of institutionalized elders. The sample size included forty older adults with musculoskeletal pain. We did a clinical assessment at baseline and weekly trough the study period of four weeks. We employed the Pittsburgh Sleep Quality Index (PSQI) and Pain Visual Analog Scale (P-VAS). Additionally a sub-group of good sleepers, selected from PSQI baseline evaluation, were studied with actigraphy and randomized to MFM or High Firm Mattress (HFM), in two consecutive nights.

We found a significant reduction of cervical, dorsal and lumbar pain. PSQI results did not change. The actigraphy evaluation found a significant shorter sleep onset latency with MFM, and a slightly better, but not statistically significant, sleep efficiency. The medium firmness mattress improved musculoskeletal pain and modified the sleep latency.

1. Introduction

Quality of sleep is associated with age-related changes, medical or psychiatric diseases and primary sleep disorders. Aging, itself, modifies the sleep architecture, with disruption of the sleep-wake cycle and increasing arousals and awakenings [1]. The National Sleep Foundation, in the Sleep in America Survey, reported that about 52% of the older adults with major comorbidity reported one or more sleep problems, compared with 36% of the participants reporting no comorbidity [2]. Likewise, several studies found that disturbed sleep is rare in healthy older adults [3].

The sleeping thermal environments, including the mattress and bed equipment (sheets, blankets and pillows), play a role in quality of sleep [4]. One survey estimated that 7% of sleep problems were related to an uncomfortable mattress [5] contributing to poor quality of sleep or physical discomfort. Moreover, several studies indicate that a mattress with ergonomic standards could improve the quality of sleep

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[6,7]. Some studies evaluate the association between sleep surface, sleep quality and pain (back and shoulder) [8,9]. Bader et al. [10] concluded that mattress differences did not significantly affect sleep quality, whereas others consider that those with different firmness or construction can affect quality of sleep [11].

Our aim was to evaluate the impact of a Medium-Firm Mattress (MFM) on sleep quality and musculoskeletal pain in institutionalized elders, and to evaluate in a subgroup of good sleepers the effect in sleep parameters through actigraphy.

2. Materials and methods

We conducted a quasi-experimental study.

2.1. Participants

All the participants were institutionalized older adults (>60 year old), who slept on foam mattresses on an adjustable bed in a public nursing home. In order to find the sample size, we used the formula for studies of contrast hypothesis. We included 40 subjects with musculoskeletal pain who were evaluated by a geriatrician. Evaluation included BMI, polypharmacy, nutritional status and nicturia. Exclusion criteria were: bedridden subjects, moderate to severe dementia, acute illness and subjects who had recent surgery. Additionally, all patients with normal PSQI and without psychotropic medication at baseline were studied for two nights with actigraphy.

2.2. Ethical approval and informed consent

The study protocol was approved by the Institutional Review Board of the Universidad Peruana Cayetano Heredia. Informed consent was obtained prior to initiation of the study.

2.3. Questionnaires and devices

The Pittsburgh Sleep Quality Index (PSQI) is an 18-item self-report questionnaire. The items produce seven component scores which range from 0 (no difficulty) to 3 (severe difficulty): sleep duration, sleep disturbance, sleep latency, daytime dysfunction, habitual sleep efficiency, sleep quality, and use of sleep medications. The sum of these component scores yields a measure of global sleep quality which ranges from 0 to 21. A global PSQI score greater than 5 has a diagnostic sensitivity of 89.6% and specificity of 86.5% in distinguishing good and poor sleepers [12]. We used the Pittsburg Sleep Quality Index validated in Colombia (ICSP) [13].

The Pain Visual Analog Scale (P-VAS) measurement was introduced by Huskisson [14]. It is a continuous scale, 10 cm in length, anchored by 2 verbal descriptors. The P-VAS for musculoskeletal pain contained “no pain” on the far left and “extreme pain” on the far right side of the line.

The Actiwatch 2 (Phillips-Respironics) is a portable device with the size of a large wrist watch, and it consists of a solid state “piezoelectric” accelerometer with a range of 0.5–2 G, bandwidth 0.35–7.5 Hz, Sensitivity of 0.025 G and a sampling rate of 32 Hz. This instrument is validated for different sleep disorders [15], the American Academy of Sleep Medicine (AASM) has concluded that an actigraph can provide objective measures of sleep patterns [16]. In older adults (including older nursing home residents), in whom traditional sleep monitoring can be difficult, actigraphy is indicated for characterizing sleep and circadian patterns and to document treatment responses due its high sensitivity [17].

The Actiwatch 2 database was analyzed using Encore Pro 2 version 2.2 (Patient Management System) software [18,19]. The database include Bed Time (BT), Get up Time (GT), Sleep Onset Latency (SOL), Wakefulness after Initial Sleep Onset (WASO), Number of Awakenings (NA), Total Sleep Time (TST), Total Time Spent in Bed (TIB), Sleep Efficiency (SE).

2.4. Procedures

All the selected participants that fulfilled the inclusion and exclusion criteria completed the P-VAS and PSQI. The regular mattresses of the 40 participants were changed to Medium Firm Mattress (MFM). Subjects slept in their own beds with their personal linen and pillows without thermal additional modifications. A follow up was done using P-VAS every week, during 4 weeks. Participants completed the PSQI at the end of the 4 weeks evaluation.

In the actigraphy evaluation, the subjects were randomized between MFM and HFM, the transition between MFM and HFM was at random sequences for two consecutive nights.

The P-VAS and PSQI were applied by a blinded evaluator. For the Actigraphy evaluation, participants and the evaluator were blinded about which mattress was used each night. An independent researcher analyzed the outcome and the statistical correlations.

2.5. Mattress

The hardness of each mattress was measured in Newtown with a calibrated durometer. Mattress features are described in Table 1. Additionally, hardness was rated through a VAS in a healthy group of volunteers. The scale ranged from 1 (hard) to 10 (soft). The MFM was rated as 3–6 in 80% of volunteers.

2.6. Statistic analysis

Data were analyzed using SPSS for Windows version 13.0 (Chicago, IL, USA). Demographic data are presented using descriptive statistics, for categorical variables we used frequencies and percentages and for numeric variables, mean and standard deviation. The analysis of associations of variables was performed using chi-square and ANOVA. Age, BMI, Nicturia, Psycotrophic medication, polypharmacy, variation in P-VA for cervical, dorsal and lumbar pain were used for Spearman correlation analysis. In the actigraphy evaluation, quantitative variables were analyzed using nonparametric tests and qualitative variables were dichotomized and evaluated with Fisher's exact test. Statistical significance was set at $p<0.05$.

3. Results

The population selected for the study is described in Fig. 1.