

Changes in sleep architecture after burn injury: 'Waking up' to this unaddressed aspect of postburn rehabilitation in the developing world

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BACKGROUND: Changes in sleep architecture are common phenomena observed in post-traumatic patients; such altered sleeping patterns have negative implications on various phases of rehabilitation. Sleep is an essential process, without which one cannot function effectively and, hence, any aberrations in the quality of sleep in such patients need to be critically analyzed.

OBJECTIVE: To probe the quality of sleep in postburn patients at one year compared with a group of adequately matched controls.

METHODS: Quality of sleep in postburn patients at one year was measured using the Pittsburg Sleep Quality Index questionnaire and compared with a group of adequately matched controls. Data were tabulated and subjected to statistical analysis using Pearson's χ^2 test.

RESULTS: The relationship between the postburn state and sleep disturbances was found to be statistically significant. Other relevant parameters are also highlighted and discussed.

DISCUSSION: Sleep is one of aspect of functioning that may be least taken into account by professionals during the phase of postburn rehabilitation because more obvious threats receive preferred treatment. Unless these problems are dealt with in the postburn period, rehabilitation can never be complete.

CONCLUSION: Postburn patients experience significant changes in sleep architecture, which need to be taken into account to enable complete rehabilitation of the patient.

Key Words: *Burn injury; PSQI questionnaire; Rehabilitation; Sleep architecture*

Changes in sleep architecture are common phenomena in post-traumatic patients (1) and such altered sleeping patterns have negative implications on various phases of rehabilitation (2). Given that burn injury is one of the worst forms of trauma that can be inflicted on a human being (3,4), the assumption that postburn injury patients are potential candidates in whom such disturbances may be present is highly relevant.

Ironically, we are often disappointed by the paucity of literature that is available on this topic. The pursuit of aggressive rehabilitation and moving away from a 'myopic approach' that caters only to physical scars and neglects the mental health of burn patients has been a praiseworthy achievement on the part of burn care professionals (5). Burn rehabilitation has become pre-emptive, comprehensive and objective, taking into account nearly 'all that matters'. Even then, probing the quality and patterns of sleep in postburn patients appears to be one of the last few uncharted territories that has remained unexplored by the burn care physician.

Poor sleep quality has a number of negative effects on physical as well as mental health. Apart from its predictable effects on mental health (eg, easy fatigability, depression and pain tolerance) (6,7), it also compromises immune, metabolic and neuroendocrine functions.

Les changements à l'architecture du sommeil après une brûlure : réagir à cet aspect oublié de la réadaptation après une brûlure dans le monde industrialisé

HISTORIQUE : Les modifications à l'architecture du sommeil sont courantes chez les patients après un choc post-traumatique. Une telle perturbation des habitudes de sommeil a des conséquences négatives sur les différentes phases de la réadaptation. Le sommeil est un processus essentiel, sans lequel il est impossible de fonctionner avec efficacité. C'est pourquoi il faut procéder à l'analyse critique des aberrations à la qualité du sommeil de ces patients.

OBJECTIF : Sonder la qualité du sommeil chez les patients qui ont subi des brûlures par rapport à celle d'un groupe de sujets témoins appariés de manière pertinente.

MÉTHODOLOGIE : Les chercheurs ont mesuré la qualité du sommeil après que des patients eurent été victimes de brûlures à l'aide du questionnaire PSQI sur l'indice de qualité du sommeil de Pittsburg et ont comparé les résultats à ceux d'un groupe de sujets témoins appariés de manière pertinente. Ils ont mis les résultats en tableau et les ont soumis à l'analyse statistique au moyen du test du χ^2 de Pearson.

RÉSULTATS : Le lien entre le statut après les brûlures et les perturbations du sommeil a été considéré comme significatif. D'autres paramètres pertinents sont également soulignés et exposés.

EXPOSÉ : Le sommeil est un aspect du fonctionnement dont les professionnels tiennent peut-être moins compte pendant la réadaptation après des brûlures, car les problèmes plus évidents sont favorisés. À moins qu'on règle ces problèmes dans la période suivant les brûlures, la réadaptation ne pourra jamais être complétée.

CONCLUSION : Après des brûlures, les patients présentent des changements importants à l'architecture de leur sommeil, dont il faut tenir compte pour mener leur réadaptation à terme.

In addition, it also chronically activates the hypothalamic-pituitary-adrenal axis and increases mortality risk (8). Even short periods of disrupted sleep can wreck havoc on physical health (9). As long as the patient spends sleepless nights tossing and turning in bed, no rehabilitation process can be deemed adequate. Moreover, such a scenario has the propensity to negate the rest of the good work performed in terms of rehabilitation and can aggravate other aspects of patient's mental health, most notably depression and post-traumatic stress disorder (PTSD). Therefore, it is imperative to ascertain the status of sleep patterns prevalent in postburn patients and bring to the forefront any deviations from normal that may exist so they can be dealt with more efficiently to move the patient as near as possible to 'total rehabilitation'.

The purpose of the present study was to determine the quality and nature of sleep patterns in postburn patients along with the various relevant social, clinical and demographic parameters associated with such altered patterns. The present large-volume study attempted to highlight aberrations in the sleep habits of such patients, which has largely been an under-reported phenomenon, especially in the developing world.

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METHODS

The present analysis was a prospective study involving 1282 burn patients who were admitted to the Jawaharlal Nehru Medical College Hospital, AMU Campus (Aligarh, India) between June 2010 and June 2012. Of these, 818 patients were found to be eligible based on the following inclusion criteria: >15 years of age; absence of any sleep-related problems before burn injury, as described by the patient including history of sleep apnea; individuals without jobs involving night shifts or excessive travel; absence of comorbid conditions that can cause altered sleep patterns such as chronic asthma, chronic obstructive pulmonary disease or obesity; restrained consumption of tea/alcohol (<5 cups of 8 oz [237 mL]/day, especially before bed); minimum follow-up period of one year after date of discharge; and no previous use of sleep-inducing or sedative medication.

Quality and pattern of sleep was investigated using the Pittsburgh Sleep Quality Index (PSQI) questionnaire one year after burn injury. The PSQI questionnaire is an effective instrument used to measure the quality and patterns of sleep in the adult population. It differentiates 'poor' from 'good' sleep by measuring seven domains: subjective sleep quality; sleep latency; sleep duration; habitual sleep efficiency and sleep disturbances; use of sleep medication; and daytime dysfunction over the previous month. The patient self-rates each of these seven areas of sleep. Scoring of the answers is based on a scale from 0 to 3, in which 3 reflects the negative extreme on the Likert scale. A global sum of ≥ 5 indicates 'poor' sleep.

Another group of patients (n=600) attending the outpatient department for nonburn-related conditions (usually simple conditions such as sebaceous cysts, scar revisions, post-rhinoplasty cases, mandible, etc) were considered as controls (Table 1).

The inclusion criteria for the controls were the same as the subjects and, hence, they were stringently matched for age, absence of previous sleeping disorders, socioeconomic status and education, and were followed-up for one year after which they completed the same questionnaire as the controls.

RESULTS

Of a total of 1282 burn patients admitted to hospital from June 2010 to June 2012, 818 were found to be eligible for the present study based on the inclusion criteria previously described and were further analyzed.

At 12 months postdischarge, they were asked to describe their postburn sleep quality and sleeping patterns compared with their preburn state by completing the PSQI questionnaire. The PSQI questionnaire is a subjective measure of sleep. Psychometric properties of the PSQI have been examined and found to be appropriate with regard to internal consistency (10,11), concurrent validity (11,12) and discriminative validity (11,12) in healthy and ill populations. The PSQI questionnaire has internal consistency and a reliability coefficient (Cronbach's alpha) of 0.83 for its seven components. Numerous studies using this questionnaire in a variety of older adult populations internationally have supported its high validity and reliability.

Of the 818 patients interviewed, 501 (61.24%) responded positively to the PSQI questionnaire (score >5) while 317 (38.75%) responded negatively (score <5). Scoring of the answers is based on a 0 to 3 scale, in which 3 reflects the negative extreme on the Likert Scale. A global sum of ≥ 5 indicates 'poor' sleep.

In the control population (n=600), however, 405 (61%) patients had a PSQI score <5 while 195 (31%) had a PSQI score >5, which signifies poor sleep. When the two results were compared using a 2×2 χ^2 test (Pearson), there was a marked difference in the PSQI values of the two groups (χ^2 value 114.45, df=1; two-tailed $P < 0.0001$).

Further analysis of the PSQI questionnaire revealed that the most troublesome aspects of patients' sleep were: increased duration of time spent awake in bed before falling asleep; abnormal postures due to contractures/pain, making falling asleep difficult; nightmares; short bouts of sleep punctuated by frequent awakening; difficulty in breathing; and arising late in the morning and not feeling well rested.

TABLE 1

Sociodemographic characteristics of patients and controls

	Patients (n=818)	Controls (n=600)
Age, years		
<20	103 (12.57)	80 (13.33)
20–30	408 (49.88)	263 (43.88)
30–40	206 (25.18)	181 (30.16)
40–50	51 (6.23)	30 (5.0)
>50	50 (6.11)	46 (8.0)
Education		
Literate (matriculate)	493 (60.26)	360 (59.83)
Semiliterate	188 (22.9)	105 (17.5)
Illiterate	135 (16.50)	135 (22)
Socioeconomic status (Prasad class)		
1	498 (60.88)	340 (56.83)
2	190 (23.22)	120 (19.66)
3	130 (15.89)	140 (23.33)

Data presented as n (%)

Subjects with scores >5 (poor sleepers) were further analyzed and the following details were noted: of the 501 individuals who were poor sleepers, 289 (57.6%) were male and 212 (42.31%) were female. The age distribution of these patients is described in Table 2 and the largest group was 20 to 30 years of age.

The total body surface area (TBSA) of these patients is described in Table 2 and most of these patients had a TBSA of 20% to 40%, with mostly second-degree burns at the time of admission (as retrieved from patient records).

On clinical examination, the head and neck region were involved in 227 patients (45.30%), the abdomen and chest was involved in 180 (35.92%) and 94 (18.76%) experienced burns in other areas.

With regard to etiology, the largest group was that of flame burns (n=383 [60%]), electrical burns (n=65) followed by scald burns (n=53 [18.40%]), with scald burns being more common among women (Table 2).

The most common place of burn injury was the home (83%) followed by the workplace (12%). The majority of the burns were accidental in nature, with only 12 cases of homicidal and five cases of suicidal burns as per the history provided by the patient. Of the 501 patients, 296 (48.65%) were unmarried.

Regarding education level, 255 patients were literate (having passed 10th grade), 144 were semiliterate (being able to read and write) while 102 were illiterate. Two hundred three patients belonged to class 1, 153 patients belonged to class 2 and the rest belonged to class 3 according to Prasad's modified economic classification. The relevant features of the cases who had PSQI scores >5 and, thus, an unsatisfactory sleep pattern are shown in (Table 2).

Age and sex distribution of the burn patients with abnormal sleep patterns (n=501) were comparable with those of burn patients with normal sleep patterns (n=317). With regard to TBSA, the maximum number of patients experiencing abnormal sleep belonged to the 20% to 40% group (53.09%) whereas those having normal sleep had burns involving a maximum of <20% TBSA (66.88%). The mean TBSA in the abnormal sleep group was 33.11% while it was 22.88% in the normal sleep group.

In burn patients with abnormal sleep, the most common region involved was the upper half of body, of which the face and neck region was the most commonly involved part (45.31%), whereas the trunk region was the most affected part in the group of patients who experienced normal sleep (42.90%).

In the abnormal sleep group, the majority (53.49%) of patients had a hospital stay of 20 to 30 days, whereas in the group having normal sleep, 60.57% of the patients had hospital stays of 10 to 20 days. The mean number of operations performed in the abnormal sleep group was 1.52 compared with 1.02 in the normal sleep group; 13.98%

TABLE 2
Comparison of important findings between the affected burn patients (sleep disturbances present) and unaffected burn patients

	Burn patients	
	Abnormal sleep (n=501)	Normal sleep (n=317)
Sex		
Male	289 (57.68)	172 (54.25)
Female	212 (42.31)	145 (45.74)
Age, years		
<20	64 (12.77)	38 (11.99)
20–30	188 (37.52)	80 (25.24)
30–40	71 (14.17)	96 (30.28)
40–50	102 (20.35)	68 (21.45)
>50	71 (14.17)	35 (11.04)
Total body surface area, %		
<20	136 (27.14)	212 (66.88)
20–40	266 (53.09)	76 (23.97)
>40	99 (19.76)	29 (9.14)
Mode of injury		
Thermal	383 (76.44)	222 (70.03)
Electrical	64 (12.77)	60 (18.93)
Scalds	53 (10.57)	35 (11.04)
Place of occurrence		
Home	498 (83)	249 (78.55)
Workplace	60 (12)	46 (14.51)
Others	26 (5)	22 (6.94)
Socioeconomic status (Prasad s class)		
1	203 (40.51)	140 (44.16)
2	153 (30.53)	82 (25.87)
3	145 (28.94)	95 (29.97)
Anatomical site of burn		
Upper half of body	457 (91.22)	219 (69.09)
Lower half of body	44 (8.78)	98 (30.91)
Predominant part involved		
Face and neck	227 (45.31)	87 (27.44)
Upper limb and axilla	50 (9.98)	22 (6.94)
Trunk	180 (35.93)	136 (42.90)
Groin	8 (1.60)	10 (3.15)
Lower limbs	36 (7.18)	62 (19.56)
Duration of admission, days		
<10	45 (8.98)	75 (23.66)
10–20	140 (27.94)	192 (60.57)
20–30	268 (53.49)	38 (11.99)
>30	48 (9.58)	12 (3.79)
Operations, n		
0	90 (17.96)	121 (38.17)
1	166 (33.13)	103 (32.49)
2	148 (29.54)	61 (19.24)
3	73 (14.57)	23 (7.26)
>3	24 (4.79)	9 (2.84)
Inhalational injury	70 (13.98)	34 (10.73)

Data presented as n (%)

experienced inhalational injury in the abnormal sleep group compared with 10.73% of the normal sleep group.

Regarding employment status, 295 (58.92%) patients revealed that they had either not returned to their previous professions or were not comfortable with their previous jobs and devoted a major portion of their day either resting or engaging in minimal movement.

A total of 166 (20.29%) patients revealed consulting a psychiatrist for their psychosomatic states including sleep disturbances

TABLE 3
Significance of Pittsburg Sleep Quality Index (PSQI) values in postburn patients versus nonburn patients

	Postburn patients (n=818)	Nonburn patients (n=600)
PSQI score <5	317	405
PSQI score >5	501	195

Data presented as n. $\chi^2=114.4545$ (df=1); two-tailed $P<0.0001$

and 38 (4.64%) admitted being on medication prescribed by the psychiatrist. Twenty-six of these patients were being treated for anxiety, 10 were being treated for post-traumatic depression and two for other illnesses.

DISCUSSION

Burn injuries have the potential to affect an individual physically as well as mentally. A burn patient is predisposed to various psychosomatic disorders including depression (13), PTSD (14), anxiety (15) and psychosis (16). While these well-known associations have been extensively covered in the literature, at the same time, little attention has been devoted to the prevalent sleep patterns of burn patients, which are an important parameter of psychosomatic well being and, hence, an integral part of postburn rehabilitation.

Humans spend approximately one-third of their lives asleep. Sleep is an essential and involuntary process, without which we cannot function effectively. It is as important to our bodies as food, water and breathing, and is vital for maintaining good mental and physical health. A normal sleep pattern appears to be essential for the survival and integrity of most living organisms. Many nonmutually exclusive roles have been attributed to sleep: brain thermoregulation (17); neuronal detoxification (18); energy conservation (19); tissue restoration (20); immune defense (21); and brain plasticity (22). Considering the already disturbed homeostatic mechanisms present in burn patients, added sleep-related issues can negatively affect the patient's general well being and, therefore, interfere with the process of rehabilitation. The direct and indirect costs of sleep problems are also substantial (23).

The aim of the present study was to gain insight into the quality and patterns of sleep prevalent in postburn patients. Previous research has devoted very little attention to these parameters despite their importance as described earlier. Our study was able to highlight some vital findings that may serve as the basis of gaining insight into the epidemiology as well as help understand the various other parameters involved. Subsequently, it may help us to formulate a better strategy to deal with these issues and improve the quality and pattern of sleep in burn patients.

Quality of sleep was investigated by having the patients and controls complete the PSQI questionnaire, 12 months postburn/postcontact, respectively. Previous research has shown that the PSQI questionnaire is a reliable and valid instrument for the measurement of quality and pattern of sleep (10). The comparison of PQLI scores in two groups (patients versus controls) using a $2 \times 2 \chi^2$ test (Pearson) revealed highly significant results ($\chi^2=114.45$, df=1; two-tailed $P<0.0001$). Thus, there was a clearly evident deterioration in the quality and architecture of sleep in postburn patients, which was the most significant finding of the present study (Table 3).

While being preoccupied with the treatment of more serious problems that burns patients face, we tend to downplay the significance of disturbed sleep patterns or, at the most, prescribe a routine benzodiazepine. Despite the individual and societal burden of sleep problems, most (80% to 90%) remain undiagnosed (24). Only when a patient's sleeping difficulties are assessed independent of other concurrent problems (which may, of course, be more deserving of attention) can we realize the significance of a sleepless night. Because these patients are already vulnerable to various psychosomatic conditions (depression, anxiety, PTSD), altered sleep patterns can only add to the severity of these conditions and also potentially negate the benefits achieved on the basis of a thorough mental rehabilitation.

TABLE 4
Most debilitating factor hampering sleep patterns in burn patients

Problem	n
Increased duration of time spent awake in bed before falling asleep	138
Abnormal postures due to contractures/pain making falling asleep difficult	71
Nightmares	65
Short bouts of sleep punctuated by frequent awakening	54
Difficulty in breathing	36
Arising late in the morning	32
Vague complaints	105

We considered various demographic variables such as sex, age, marital status, education, occupation and residential status, and TBSA in the set of patients who had a score >5.

Among the patients who reported changes in their sleep architecture, there was no significant difference based on sex. As far as other psychosomatic disturbances in postburn patients are concerned, differences according to sex have been observed, with these disorders being more common in women (25). Sleep quality is an integral component of an individual's overall well-being, and appeared to be equally affected in both sexes in the present study. A possible explanation for the slightly greater number of males may be that in this part of the world, society is largely masculocentric and men were more vocal about changes in their sleep patterns and the severity of their complaints while women were more subdued in reporting the same problem.

In our setting, all burn patients are managed in a separate high-dependency unit after initial resuscitation, which is temperature controlled and suitably disinfected as per requirement. Patients with inhalational injuries are managed with urgent tracheostomy in the same high-dependency unit. As a routine measure, adequate splinting is performed for all affected areas including the neck. Despite adequate splinting, the rate of contractures continue to be high due to the inadequate patient compliance. Surgeries for contractures are performed after adequate scar maturation.

Patients 20 to 30 years of age presented with the highest rates of sleep abnormalities compared with other patients. The third decade of life is usually the most productive in terms of a patient's occupation, marital status and zeal for life (26). This particular age group tends to be more apprehensive about their future in terms of cosmetic disfigurement, financial losses and family building. Overall, this may be responsible for a greater level of anxiety and changes in sleep patterns in this particular age group. Studies have suggested that age at the time of burn injury is related to postburn psychological adjustment (27). Thus, sleep disturbances in younger patients with nascent intellect are more profound compared with older, wiser patients.

On measuring the relationship between TBSA and deranged sleep patterns, our study revealed that the most profoundly affected group was that with a TBSA of 20% to 40%. It is worthwhile to mention here that the mortality rate of burn patients with TBSA >50% in our facility is substantially higher than those with TBSA <50%. Whether the above finding is a true reflection of the actual scenario or is a skewed result is debatable because patients with greater TBSA would tend to experience more significant alterations in their physical and mental attributes and, subsequently, their sleep patterns.

Because patients with greater TBSA tend to stay in hospital for a longer duration, an ancillary observation was that increased hospital stay was also associated with more observable derangements in sleep architecture compared with shorter stays (Table 4).

Regarding socioeconomic status of the subset of patients with positive PSQI results, we found that sleep disturbances were more prevalent in individuals belonging to higher socioeconomic strata (Prasad

TABLE 5
Most common physical findings in with patients with Pittsburgh Quality Sleep Index score >5

Finding*	n
Postburn neck contracture	133
Severe itch	86
Unstable scars/ulcers	43
Painful scars/contractures	38
Insignificant findings (nonhypertrophic scars, extensive scarring, etc)	201

*Some patients had overlapping physical findings

modified class 2,3) compared with subjects from lower socioeconomic strata. These findings were also noted in educational level, with positive association between sleep disturbances and subjects having passed their 10th standard (considered to be literate) followed by semiliterate (being able to read only) followed by illiterate (neither able to read nor write). Patients at lower socioeconomic and literacy strata were more preoccupied with matters of practical implications (monetary, occupational) and, hence, less vocal about their altered sleep quality. The majority of patients who responded positively to the PSQI subset had mixed second- and third-degree burns.

The physical comorbidities that were associated with having altered sleep habits are highlighted in Table 5. The most common among these were contracture present in the neck region followed by severe itch. Postburn contractures have already been related to various psychosomatic pathologies in burn patients apart from the obvious cosmetic aberrations (28). By virtue of the above-mentioned mental and the already established physical attributes (decreased range of motion of neck, abnormal posturing while lying down), postburn neck contractures appear to be far more common in patients with altered sleep patterns. Our study is the first one to highlight this fact and, thus, we must be liberal in the use of sleep medication/early initiation of cognitive therapy in these patients.

When asked to indicate the single most worrying factor that keeps them awake, the most common results were: apprehensions regarding appearance; financial/employment worries; pain; fatigue and easy weariness; itching; and conjugal worries (in unmarried subjects).

As is obvious from the findings of the present study, both mental and physical factors were responsible for the altered sleep patterns present in postburn patients and, accordingly, an approach to tackle this problem must be one that incorporates physical and mental rehabilitation. Previous recommendations in general have included those by Morin and Ware (29), that a systematic assessment of sleep be incorporated into all psychological evaluations. Practitioners should ask about the onset of the sleep disorder and, if associated with a psychiatric disorder, the temporal sequence should be evaluated of when the sleep disorder and the psychiatric disorder manifested. Did the symptoms of the psychiatric disorder predate the onset of sleep problems or vice versa?

Polysomnographic studies can also reveal whether there are any sleep-breathing or sleep-movement disorders that may also be treated. These conditions often improve with medication and/or assistive devices.

However, cognitive-behavioral interventions are appropriate for treating most sleep problems. In one recent review, it was effective for 70% to 80% of patients, and was comparable with sleep medications (30). Cognitive-behavioural interventions help with sleep because they produce changes in REM sleep. Cognitive approaches can also address worry and rumination, which may be the foundation of primary or secondary insomnia. Cognitive therapy for insomnia includes three components: behavioural, cognitive and educational. Behavioural aspects include establishing regular bedtimes, not using the bed for anything but sleep and sex, getting out of bed when unable to sleep and eliminating naps during the day. Sleep-hygiene education helps people minimize behaviours that may interfere with sleep. This may include eliminating caffeine, exercise, alcohol and smoking near bedtime (31).

Stress reduction includes a relaxation component that focuses on both autonomic relaxation techniques (eg, progressive muscle relaxation) and cognitive techniques that address the 'worry component' that keeps people from sleeping. A combination of cognitive, behavioural and stress-reduction approaches are effective for most patients with sleep disorders.

Judicious use of sleep medications may also prove beneficial in many cases. Pharmacological treatment should be guided by the principle of using the least complex approach to achieve the broadest relief of signs and symptoms. Medication can be used as the sole treatment or as an adjunct to cognitive behavioral therapy for insomnia or imagery rehearsal therapy. Treatment options may include selective serotonin reuptake inhibitors, benzodiazepines or venlafaxine.

There is evidence that mirtazapine and nefazodone are helpful for PTSD-related sleep disturbances and can be considered as single-agent alternatives to selective serotonin reuptake inhibitors or venlafaxine. A comprehensive assessment of the contributing factors to the sleep disturbance is needed so that the clinician can optimize treatment and decide when referral for additional consultation and treatment may be indicated.

Sleep is one aspect of functioning that is usually least taken into account by professionals during the phase of postburn rehabilitation. Even among patients, it is probably last on their list of priorities

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SUMMARY

The aim of the present study was to gain insight into the quality and patterns of sleep prevalent in postburn patients. Our study was able to highlight some vital findings on this topic, which may serve as the basis of gaining an insight into the epidemiology as well as an understanding of the various other parameters involved. Subsequently, it may help us formulate a better strategy to deal with them and improve aspects of their quality and pattern of sleep.

DISCLOSURES: There are no conflicts of interest to declare. Dr Masoodi is working as a resident in the division of Plastic, Burn & Reconstructive Surgery. Fees paid for statistical consultation were self-funded.