

Psychological impact of burn scars on quality of life in patients with extensive burns who received allotransplant

C. NIȚESCU¹⁾, D. R. CALOTĂ¹⁾, T. A. STĂNCIOIU¹⁾,
 S. A. MARINESCU²⁾, I. P. FLORESCU²⁾, I. LASCĂR³⁾

¹⁾Clinical Emergency Hospital for Plastic, Reconstructive
 and Burns Surgery, Bucharest

²⁾Department of Plastic Surgery and Reconstructive Microsurgery,
 "Bagdasar-Arseni" Emergency Hospital, Bucharest

³⁾Department of Plastic Surgery and Reconstructive Microsurgery,
 Clinical Emergency Hospital, Bucharest
 "Carol Davila" University of Medicine and Pharmacy, Bucharest

Abstract

With the remarkable progress in the field of burns treatment, the outcome of extensive burns improved significantly. The increased likelihood of survival of a burn victim heightens concerns for potential psychological morbidity for the survivors. Hypertrophic scarring is devastating and can result in disfigurement that affects quality of life. To assess the impact of burn scars on the quality of life of the survivors, we used two scales: the WHOQOL-BREF questionnaire to evaluate the quality of life and the POSAS scale for the subjective evaluation of the post-burn scars in 26 patients who suffered extensive burns and received allotransplant. A significant correlation was observed between the WHOQOL-BREF score and POSAS scale ($r=-0.93$, $p<0.001$). In conclusion, burn scar visibility and severity did have a strong relationship with the quality of life in the survivors of a major burn who received allotransplant. Therefore, more effort must be placed into developing psychosocial interventions that help survivors to accept scars, reduce depression and build a strong supportive system.

Keywords: extensive burns, allotransplant, quality of life, hypertrophic scars.

Introduction

Extensive burns represent not only a very serious illness with potentially fatal complications, but also profound traumatic events, with significant potential for development of complex psychological problems, with multiple ramifications. With the remarkable progress in the field of burns treatment, the outcome of extensive burns (Total Burned Surface Area, TBSA>25%) improved significantly, with recorded cases of survival even after 95% TBSA burns [1, 2]. In general, patients with burns over 45% TBSA benefit of allotransplant (using free split-thickness skin grafts stored in skin bank or taken from donors) for serial excision-grafting interventions. All this treatment is very expensive, involving considerable human and material resources; such patients are discharged after 60–80 days of hospitalization (it is estimated one day of hospitalization/percentage of TBSA).

In fact, burn survivors experience a series of traumatic assaults to the body and mind, which represent extraordinary challenges to the psychological team [3]. Contrary to what might be expected, empirical data regarding the long-term outcome of burn injuries indicate that many burn survivors do achieve a satisfying quality of life, and that most of them are judged to be well-adjusted individuals. However, thirty percent of any given sample

of adult burn survivors consistently demonstrate moderate to severe psychological and/or social difficulties [3, 4].

Clinical observations and patient self-reports, as well as several empirical studies suggest that burn care of a burned victim, including early and continued attention to psychosocial aspects of the patient's life, can facilitate positive psychological adaptation to the challenges of traumatic injury, painful treatment, and permanent disfigurement [5–7] (Figure 1).



Figure 1 – Facial post-burn scars, at 12 months after the accident.

For decades, hypertrophic scarring, contraction and pigment abnormalities have altered the future for both children and adults after thermal injury (Figures 2 and 3).



Figure 2 – Post-combustion in regions initially grafted with allografts subsequently replaced with homografts, final appearance at 12 months after the accident.

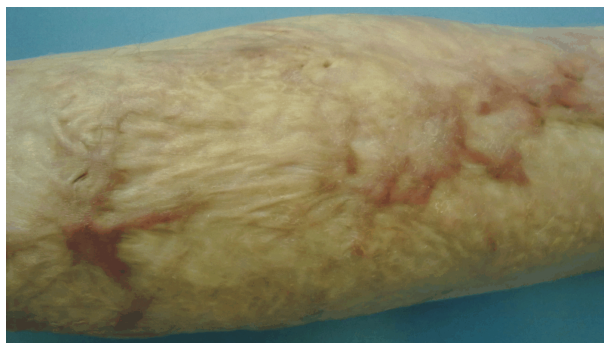


Figure 3 – Hypertrophic scar in the forearm, at 12 months after burning.

The specific causes remain essentially unknown and, at present time, prevention and treatment are symptomatic and marginal at best. To assess the impact of burn scars on the quality of life of the patients who suffered extensive burns and received allotransplant, we decided to use two specific and already validated scales: the WHOQOL-BREF questionnaire to estimate the quality of life of the survivors, and the *Patient and Observer Scar Assessment Score* for the subjective evaluation of the post-burn scars in this patients.

☐ Patients and Methods

Patients

A previous retrospective study, conducted between 2002–2009 in the ICU units from Bucharest Emergency Hospital for Plastic Reconstructive and Burns Surgery, and from Plastic Surgery and Reconstructive Microsurgery Department, “Bagdasar–Arseni” Emergency Hospital, investigated the extensive burns treated in these two units. The study group was composed of 148 selected patients with burns of grade IIB or III, with burn areas $\geq 25\%$ TBSA. From this research, we started a prospective study intended to identify and quantify the main psychosocial difficulties in patients with extensive burns who received allotransplant, by applying the *WHO* questionnaire for assessing quality of life (WHOQOL-BREF).

Thus, we selected patients with extensive burns

(>25% TBSA) who received allotransplant. Of these, we eliminated all cases of death, our study aiming the psychological analysis of the survivors. To assess the quality of life in all of these patients, after completing and signing a prior informed consent, we addressed the WHOQOL-BREF questionnaire, on selected visits during the follow-up period after discharge.

On the final evaluation visit (at 12 months after discharge), we used the *Patient and Observer Scar Assessment Scale* (POSAS) in order to assess 26 scar areas of 3×3 cm belonging to the patients included in our study. Subsequently, each patient completed the patient scale for his or her scar areas. All of the observers were plastic surgeons; all of them were regularly working with burn patients.

WHOQOL-BREF questionnaire

Quality of life (QoL) is a broad ranging concept incorporating in a complex way the persons’ physical health, psychological state, level of independence, social relationships, personal beliefs and their relationships with the environment [8]. There are many accepted definitions for QoL. *WHO’s Working Groups* on QoL elaborates, in 1993, an own definition: QoL is an individual’s perception of their position in life in the context of the culture and values systems in which they live and in relation to their goals, expectations, standards and concerns [9].

Starting from their own definition of quality of life, *World Health Organization* has developed an instrument for measuring quality of life, named WHOQOL-100, a questionnaire validated by usage in numerous studies and researches [10–12]. WHOQOL is therefore a tool for evaluation of the multidimensional concept that includes the individual’s personal perception of health, psychosocial status and other aspects of life.

WHOQOL-100 was developed using a unique cross-cultural approach, whose aim was to put up with a unique tool for measuring quality of life in multiple locations, different in terms of the degree of industrialization, availability of health services and other relevant characteristics to quantify quality of life (*i.e.*, family involvement, perception of time, local customs and religion dominant) [13, 14].

Whilst the WHOQOL-100 allows a detailed assessment of individual facets relating to quality of life, it may be too lengthy for some uses, for example, in large epidemiological studies where quality of life is only one amongst many variables of interest. In these instances, assessments will be more willingly incorporated into studies if they are brief, convenient and accurate [11]. For this reasons, it has been developed WHOQOL-BREF in order to look at domain level profiles which assess quality of life, as a simplified version of the questionnaire WHOQOL-100.

WHOQOL-BREF questionnaire contains a set of 26 questions, and answers given to these questions will generate scores for four domains: physical domain (seven questions), psychological domain (six questions), social relationships domain (three questions) and the environmental factors’ domain (eight questions). In addition, there are two questions that are analyzed

separately: a question related to the individual perception of quality of life in general, and question 2, which refers to the individual's perception of his health in general (Table 1).

Table 1 – WHOQOL-BREF Questionnaire

No.	Question	Possible answers
1.	How would you rate your quality of life?	1 (very poor), 2 (poor), 3 (neither poor nor good), 4 (good), 5 (very good).
2.	How satisfied are you with your health?	1 (very dissatisfied), 2 (dissatisfied), 3 (neither satisfied nor dissatisfied), 4 (satisfied), 5 (very satisfied).
3.	To what extent do you feel that physical pain prevents you from doing what you need to do?	
4.	How much do you need any medical treatment to function in your daily life?	
5.	How much do you enjoy life?	1 (not at all), 2 (a little), 3 (a moderate amount), 4 (very much), 5 (an extreme amount).
6.	To what extent do you feel your life to be meaningful?	
7.	How well are you able to concentrate?	
8.	How safe do you feel in your daily life?	
9.	How healthy is your physical environment?	
10.	Do you have enough energy for everyday life?	
11.	Are you able to accept your bodily appearance?	1 (not at all), 2 (a little), 3 (moderately), 4 (mostly), 5 (completely).
12.	Have you enough money to meet your needs?	
13.	How available to you is the information that you need in your day-to-day life?	
14.	To what extent do you have the opportunity for leisure activities?	
15.	How well are you able to get around?	1 (very poor), 2 (poor), 3 (neither poor nor good), 4 (good), 5 (very good).
16.	How satisfied are you with your sleep?	
17.	How satisfied are you with your ability to perform your daily living activities?	
18.	How satisfied are you with your capacity for work?	
19.	How satisfied are you with yourself?	1 (very dissatisfied), 2 (dissatisfied), 3 (neither satisfied nor dissatisfied), 4 (satisfied), 5 (very satisfied).
20.	How satisfied are you with your personal relationships?	
21.	How satisfied are you with your sex life?	
22.	How satisfied are you with the support you get from your friends?	
23.	How satisfied are you with the conditions of your living place?	
24.	How satisfied are you with your access to health services?	
25.	How satisfied are you with your transport?	
26.	How often do you have negative feelings such as blue mood, despair, anxiety, depression?	1 (never), 2 (seldom), 3 (quite often), 4 (very often), 5 (always).

All questions relate to the subject's personal perception of the quality of life, health or other areas of daily living. Investigators will explain to the respondents to choose the response that appears most appropriate to

them. If undecided, the first answer that comes to mind is often the best. Throughout the test, the subject must take into account their own standards, desires, hopes, pleasures and fears. Importantly, responses must relate to life in the last four weeks.

Domain scores are scaled in a positive direction (*i.e.*, higher scores denote higher quality of life). The mean score of items within each domain is used to calculate the domain score. Mean domain scores are subsequently transformed to a 4–20 scale; all the four domain scores are then summarized in order to obtain the total score (range 16–80). Where more than 20% of data are missing from an assessment, the assessment should be discarded. Where up to two items are missing, the mean of other items in the domain is substituted. Where more than two items are missing from the domain, the domain score should not be calculated (with the exception of domain 3, where the domain should only be calculated if <1 item is missing).

POSAS scale

A scar assessment scale, which subjectively evaluates the effectiveness of scar therapies, is an important evaluation tool because it describes the impression of experts on the appearance of any given scar. A literature study shows that few of the currently available subjective scar assessment scales have been tested for reliability, feasibility and consistency [15]. It turned out that the *Patient and Observer Scar Assessment Scale* offers a suitable, reliable and complete scar evaluation tool.

The *Patient and Observer Scar Assessment Scale* (POSAS) was developed for the evaluation of all scar types (*e.g.*, linear postoperative scars, burn scars) [16]. The POSAS scale consists of two scales, the patient (subjective) scale, which contains six items, and the observer scale, which contains five items (Table 2).

Table 2 – The Patient and Observer Scar Assessment Scale (POSAS)

Observer Scar Assessment Scale	
1. Vascularity	
2. Pigmentation	1 2 3 4 5 6 7 8 9 10
3. Thickness	
4. Relief	1 = normal skin.
5. Pliability	10 = worst scar imaginable.
6. Surface area	
Overall opinion	
Patient Scar Assessment Scale	
1. Has the scar been painful the past few weeks?	1 2 3 4 5 6 7 8 9 10
2. Has the scar been itching the past few weeks?	1 = no, not at all. 10 = yes, very much.
3. Is the color different from the color of your normal skin at present?	
4. Is the stiffness of the scar different from your normal skin at present?	1 2 3 4 5 6 7 8 9 10
5. Is the thickness of the scar different from your normal skin at present?	1 = no, as normal skin.
6. Is the scar more irregular than your normal skin at present?	10 = yes, very different.
What is your overall opinion of the scar compared to normal skin?	

All items of these two scales are scored numerically. The patient scores the characteristics of the scar: color,

pliability, thickness, relief, itching, and pain, whereas the observer scores scar vascularization, pigmentation, pliability, thickness, and relief [17].

Each item is in fact a 10-step score, whereby the score 10 reflects the worst imaginable scar or sensation. The total score of the observer scale consists of adding the scores of each of the five items (range, 5 to 50). The total score of the patient scale consists of adding the scores of each of the six items (range, 6 to 60). The lowest scores, 5 and 6, respectively, reflect normal skin. In addition to the scar assessment, the observers and the patients gave a general opinion on the appearance of the scar areas (score, 1 to 10, in which a score of 10 corresponds to the worst possible scar appearance). For our purposes, we used in our analysis only the total score of the patient scale.

Statistical analysis

All the collected data were analyzed using the *Wessa.net* software [18].

The Pearson correlation with a two-tailed test of significance was used to establish the relationship between the scores at the WHOQOL-BREF questionnaire and the scores recorded for the POSAS scale. The significance criterion was set at 0.05. Pearson product-moment correlation coefficient is a measure of the strength of the supposed linear association between the two sets of values.

Results

Of the 166 subjects with extensive burns (>25% TBSA) in the original study (2002–2009) and the 47 new enrolled patients with extensive burns in the prospective study (2010–2011), we selected all the subjects with extensive burns who received allotransplant ($n=59$). Of these, we eliminated all cases of death ($n=18$), our study aiming the psychological analysis of the survivors ($n=41$). To all of these patients, after completing and signing a prior informed consent, we addressed the WHOQOL-BREF questionnaire, on selected visits during the follow-up period (at 3, 6 and 12 months after discharge). The subjects from the original study answered the questionnaire only once, this evaluation corresponding to the final evaluation (at 12 months after discharge) in the prospective group.

After eliminating the subjects lost during the follow-up period ($n=10$) and the subjects with incomplete or incorrect answers on the questionnaire ($n=5$), which formed the study group ($n=26$; Table 1).

The age of the patients ranged from 21 to 57 years; of the 26 subjects, 15 were men (sex ratio M/F=1.36).

The mean value at the WHOQOL-BREF questionnaire at 12 months after discharge was 51.80 (range, 42–63). At the same time, the mean value for the patient scores at the POSAS scale was 39.88 (range, 29–46).

In Figure 4 is represented the relationship between the scores recorded at the WHOQOL-BREF questionnaire and the values for the patient scores at the POSAS scale, using the Pearson correlation coefficient. A significant correlation was observed between the WHOQOL-BREF scores and POSAS scale ($r=-0.93$, $p<0.001$). This

negative value, very close to -1, denotes a strong negative association between the two scales used in our study, as the value of the WHOQOL-BREF score increases, the value at the POSAS score decreases.

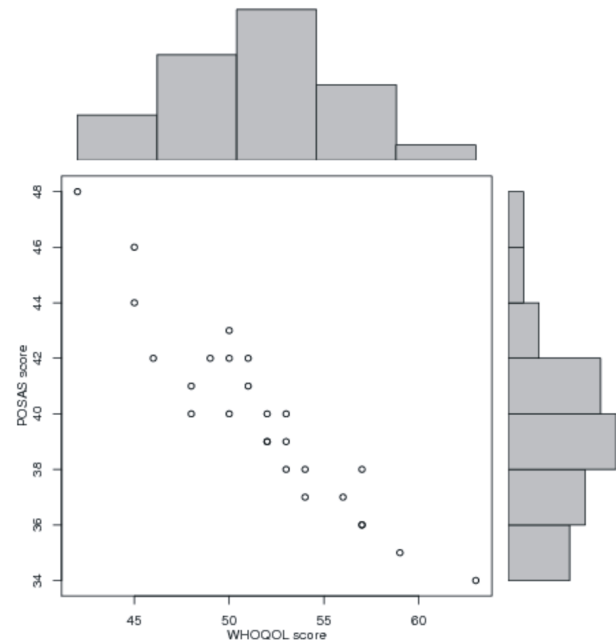


Figure 4 – Pearson correlation two-tailed test shows the negative correlation between the WHOQOL-BREF questionnaire and the POSAS scale.

Formation of a scar is an ongoing process for the burn survivor. Scars are dynamic and continue to grow and change throughout the maturation process. It is the responsibility of both the patient and health care provider to manage scars and decrease the potential for contractures [19].

Pathological cutaneous scars such as keloids and hypertrophic scars are characterized by a diffuse redness that is caused by the overgrowth of capillary vessels because of chronic inflammation.

Clinical experience suggests that hypertrophic scarring is an aberrant variant of the normal process of wound healing. However, the etiology of the over-exuberant fibrosis is unknown. Hypertrophic scarring (Figure 5) should be distinguished from keloid formation, the other major form of excessive scarring seen in humans [20].

There is stronger evidence for genetic predisposition in keloid formation than in hypertrophic scarring, although both occur more frequently in certain ethnic groups (e.g., people of African and Asian descent). Keloids are characterized by overgrowth and fibrosis beyond the boundaries of the original injury, while hypertrophic scars do not extend beyond the original wound margins [21].

Keloids and hypertrophic scars can also be differentiated by established histopathological criteria, which include differences in collagen density and orientation, vascularity, and other factors.

Histologically, both hypertrophic scars and keloids contain an overabundance of dermal collagen (Figure 6).

Hypertrophic scars contain primarily type III collagen oriented parallel to the epidermal surface with abundant nodules containing myofibroblasts, large extracellular

collagen filaments and large amounts of acidic mucopolysaccharides [22].

In contrast, keloid tissue is mostly composed of disorganized type I and III collagen, containing pale-staining hypocellular collagen bundles with no nodules

or excess myofibroblasts. Both scar types demonstrate overproduction of several fibroblast proteins, including fibronectin, suggesting either pathological persistence of wound healing signals or a failure of the appropriate downregulation of wound-healing cells [23].

Figure 5 – Histological aspects of (A) normal scars and (B) hypertrophic scars (HE stain, ob. 10×). Normal scars showed a thin epidermal layer with delicate rete ridges, limited inflammation and collagen architecture closer to that of normal skin. Hypertrophic scars are characterized by a significant epidermal thickening with parakeratosis, inflammation and increased production of abnormal collagen.

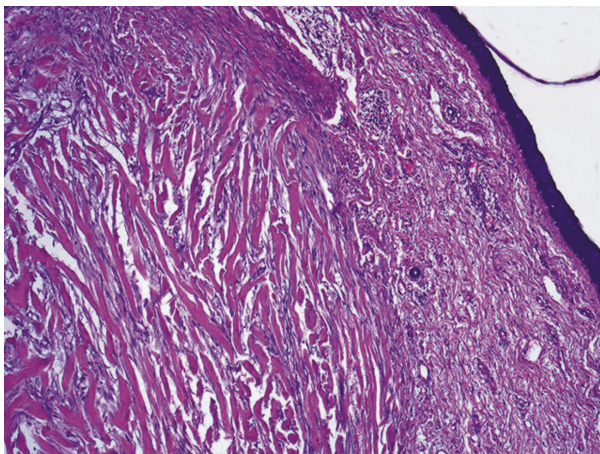
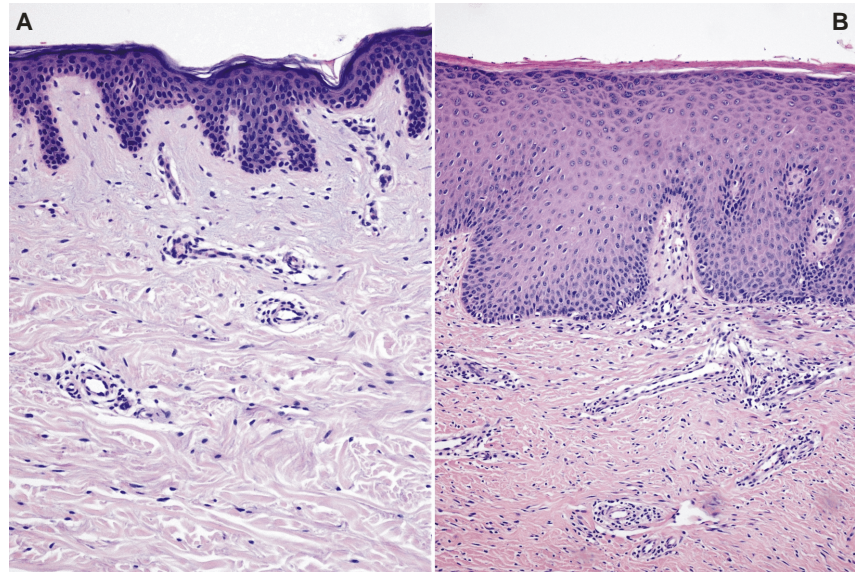


Figure 6 – Keloid scars (HE stain, ob. 10×). Deep to the epidermis (the purple-staining stratified squamous epithelium at upper right) there are interlacing broad bands of collagen; the dense collagen fibers fill the left half of the image. Note the absence of normal dermal glands, hair follicles, etc.

Discussion

Advances made over the past decades have allowed us to extend the lives of patients whose injuries would previously have been invariably fatal [24]. However, despite advances in life-saving technologies, progress to prevent the late functional and aesthetic sequelae of hypertrophic scar formation has been slow. Hypertrophic scar formation is a major clinical problem in the developing and industrialized countries, and surgical procedures can give rise to exuberant scarring those results in permanent functional loss and disfigurement [25, 26]. For instance, only in the United States, annually, over one million people require treatment for burns, two million are injured in motor vehicle accidents, and over 34 million related surgical procedures are performed.

Although the incidence of hypertrophic scar formation following these types of injuries is not known, it is a common outcome that creates a problem of enormous magnitude. It is estimated that treatment of these cases cost at least four billion USD annually in the US alone [27–29].

Efforts to limit scar formation in burn and trauma patients have relied largely on immediate skin replacement with human split-thickness allografts or dermal analogs such as Integra. Although these measures provide excellent barriers against infection and mechanical trauma, the long-term improvement in appearance has been modest. After healing has occurred, massage, pressure therapies, corticosteroids and silicone dressings are frequently used to manage the massive scar burden in these patients [30, 31]. The benefits of these therapies remain still unclear. As stated in a major review on burns and scarring, even with state-of-the-art care, “hypertrophic scarring remains a terrible clinical problem” [32].

The relationship between existing scars and psychosocial issues is obvious; a study [33] on 2500 members of a national burn survivor support group in the US demonstrates the statistically significant correlation between visible scarring and different aspects of body esteem, *i.e.* self-satisfaction with appearance and perception of others reaction to your appearance. Visible scarring had a low but significant correlation with perceived stigmatization but was not correlated with depression.

Our study, although small, has demonstrated a strong relationship between the two investigated scores, the WHOQOL-BREF questionnaire and the POSAS scale. The negative association between the values recorded at these two scores show that as the score at WHOQOL-BREF increases, the score at the POSAS scale decreases; in other words, as the quality of life is better, the self-

perception and acceptance of burn scars are better. We strongly believe that our results will be a valuable starting point for future larger randomized, multicenter and multinational trials, in order to elucidate these issues that are very interesting and difficult to solve.

✉ Conclusions

Hypertrophic scarring seems to be the major significant negative outcome after survival from of a thermal injury.

Hypertrophic scarring is devastating and can result in disfigurement that affects quality of life which, in turn, can lead to lowered self esteem, social isolation, prejudicial societal reactions and job discrimination. Scarring has also profound rehabilitation consequences, including loss of function, impairment, disability, and difficulties pursuing recreational and vocational pursuits.

In our study, burn scar visibility and severity did have a strong relationship with the quality of life in the survivors of a major burn who received allotransplant. Therefore, more effort must be placed into developing psychosocial interventions that help survivors to accept scars, reduce depression and build a strong supportive system.

Acknowledgments

This work is partially supported by the Operational Programme Human Resources Development (HRD) funded by European Social Fund and the Romanian Government Decision no. SOP 64153.

References

- [1] Blakeney PE, Meyer WJ III, Psychosocial recovery of burned patients and reintegration into society. In: Herndon DN (ed), *Total burn care*, W. B. Saunders, Philadelphia, 1996, 556–563.
- [2] Chang F, Herzog B, *Burn morbidity: a follow-up study of physical and psychological disability*, Ann Surg, 1976, 183(1):34–37.
- [3] Patterson DR, Everett JJ, Bombardier CH, Questad KA, Lee VK, Marvin JA, *Psychological effects of severe burn injuries*, Psychol Bull, 1993, 113(2):362–378.
- [4] Faber AW, Klasen HJ, Sauër EW, Vuister FM, *Psychological and social problems in burn patients after discharge. A follow-up study*, Scand J Plast Reconstr Surg Hand Surg, 1987, 21(3):307–309.
- [5] Blakeney P, Herndon DN, Desai MH, Beard S, Wales-Seale P, *Long-term psychosocial adjustment following burn injury*, J Burn Care Rehabil, 1988, 9(6):661–665.
- [6] Blakeney P, Meyer W 3rd, Robert R, Desai M, Wolf S, Herndon D, *Long-term psychosocial adaptation of children who survive burns involving 80% or greater total body surface area*, J Trauma, 1998, 44(4):625–632; discussion 633–634.
- [7] Sheridan RL, Hinson MI, Liang MH, Nackel AF, Schoenfeld DA, Ryan CM, Mulligan JL, Tompkins RG, *Long-term outcome of children surviving massive burns*, JAMA, 2000, 283(1):69–73.
- [8] Calman KC, Definitions and dimensions of quality of life. In: Aaronson NK, Beckman J (eds), *The quality of life of cancer patients*, Monograph Series of the European Organization for Research on the Treatment of Cancer (EORTC), vol. 17, Raven Press, New York, 1987.
- [9] Gerin P, Dazord A, Boissel J, Chifflet R, *Quality of life assessment in therapeutic trials: rationale for and presentation of a more appropriate instrument*, Fundam Clin Pharmacol, 1992, 6(6):263–276.
- [10] Szabo S (on behalf of the WHOQOL Group), The World Health Organisation Quality of Life (WHOQOL) Assessment Instrument. In: Spilker B (ed), *Quality of life and pharmacoeconomics in clinical trials*, 2nd edition, Lippincott-Raven Publishers, Philadelphia–New York, 1996.
- [11] The WHOQOL Group, *Development of the WHOQOL: rationale and current status*, Int J Mental Health, 1994, 23(3): 24–56.
- [12] The WHOQOL Group, The development of the World Health Organization Quality of Life Assessment Instrument (the WHOQOL). In: Orley J, Kuyken W (eds), *Quality of life assessment: international perspectives*, Springer-Verlag, Heidelberg, 1995.
- [13] The WHOQOL Group, *The World Health Organization quality of life assessment (WHOQOL): position paper from the World Health Organization*, Social Sci Med, 1995, 41(10):1403–1409.
- [14] The WHOQOL Group, *An approach to response scale development for cross-cultural questionnaires*, Eur Psychol, 1997, 2(3):270–276.
- [15] Beausang E, Floyd H, Dunn KW, Orton CI, Ferguson MW, *A new quantitative scale for clinical scar assessment*, Plast Reconstr Surg, 1998, 102(6):1954–1961.
- [16] Gold MH, *A controlled clinical trial of topical silicone gel sheeting in the treatment of hypertrophic scars and keloids*, J Am Acad Dermatol, 1994, 30(3):506–507.
- [17] Draaijers LJ, Tempelman FR, Botman YA, Tuinebreijer WE, Middelkoop E, Kreis RW, van Zuijlen PP, *The patient and observer scar assessment scale: a reliable and feasible tool for scar evaluation*, Plast Reconstr Surg, 2004, 113(7):1960–1965; discussion 1966–1967.
- [18] Wessa P, *Free Statistics Software*, Office for Research Development and Education, version 1.1.23-r7, <http://www.wessa.net/>, 2012.
- [19] Ogawa R, *The most current algorithms for the treatment and prevention of hypertrophic scars and keloids*, Plast Reconstr Surg, 2010, 125(2):557–568.
- [20] Kischer CW, Brody GS, *Structure of the collagen nodule from hypertrophic scars and keloids*, Scan Electron Microsc, 1981, (Pt 3):371–376.
- [21] Torkian BA, Yeh AT, Engel R, Sun CH, Tromberg BJ, Wong BJ, *Modeling aberrant wound healing using tissue-engineered skin constructs and multiphoton microscopy*, Arch Facial Plast Surg, 2004, 6(3):180–187.
- [22] Siemp AE, Kirschner RE, *Keloids and scars: a review of keloids and scars, their pathogenesis, risk factors, and management*, Curr Opin Pediatr, 2006, 18(4):396–402.
- [23] Sephel GC, Woodward SC, *Repair, regeneration, and fibrosis*. In: Rubin E (ed), *Rubin's pathology*, Lippincott Williams & Wilkins, Baltimore, 2001, 84–117.
- [24] Doctor ME, Psychosocial adaptation of the burn patient. In: Sood R, Achauer BM (eds), *Achauer and Sood's burn surgery: reconstruction and rehabilitation*, Saunders Elsevier, Philadelphia, 2006, 388–395.
- [25] Kammerer-Quayle B, Behavioral skills and image enhancement training for burn survivors: essential interventions for improving quality of life and community integration. In: Sood R, Achauer BM (eds), *Achauer and Sood's burn surgery: reconstruction and rehabilitation*, Saunders Elsevier, Philadelphia, 2006, 396–409.
- [26] Engrav LH, Heimbach DM, Reus JL, Harnar TJ, Marvin JA, *Early excision and grafting vs. nonoperative treatment of burns of indeterminate depth: a randomized prospective study*, J Trauma, 1983, 23(11):1001–1004.
- [27] Abdullah A, Blakeney P, Hunt R, Broemeling L, Phillips L, Herndon DN, Robson MC, *Visible scars and self-esteem in pediatric patients with burns*, J Burn Care Rehabil, 1994, 15(2):164–168.
- [28] Fauerbach JA, Heinberg LJ, Lawrence JW, Munster AM, Palombo DA, Richter D, Spence RJ, Stevens SS, Ware L, Muehlberger T, *Effect of early body image dissatisfaction on subsequent psychological and physical adjustment after disfiguring injury*, Psychosom Med, 2000, 62(4):576–582.
- [29] Brych SB, Engrav LH, Rivara FP, Ptacek JT, Lezotte DC, Esselman PC, Kowalske KJ, Gibran NS, *Time off work and return to work rates after burns: systematic review of the literature and a large two-center series*, J Burn Care Rehabil, 2001, 22(6):401–405.

- [30] Fauerbach JA, Heinberg LJ, Lawrence JW, Bryant AG, Richter L, Spence RJ, *Coping with body image changes following a disfiguring burn injury*, Health Psychol, 2002, 21(2):115–121.
- [31] Van Loey NE, Van Son MJ, *Psychopathology and psychological problems in patients with burn scars: epidemiology and management*, Am J Clin Dermatol, 2003, 4(4):245–272.
- [32] Herndon DN, LeMaster J, Beard S, Bernstein N, Lewis SR, Rutan TC, Winkler JB, Cole M, Bjarnason D, Gore D et al., *The quality of life after major thermal injury in children: an analysis of 12 survivors with greater than or equal to 80% total body, 70% third-degree burns*, J Trauma, 1986, 26(7):609–619.
- [33] Lawrence JW, Mason ST, Schomer K, Klein MB, *Epidemiology and impact of scarring after burn injury: a systematic review of the literature*, J Burn Care Res, 2012, 33(1):136–146.

Corresponding author

Tudor Andrei Stăncioiu, MD, Clinical Emergency Hospital for Plastic, Reconstructive and Burns Surgery, 218 Griviței Avenue, Sector 1, 010707 Bucharest, Romania; Phone +4021–224 09 46, Fax +4021–224 18 00, e-mail: stancioiu.andrei@gmail.com

Received: March 15th, 2012

Accepted: July 27th, 2012