Quantitative postural analysis and pain in children and adolescents victims of burns

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Abstract. [Purpose] This study aimed to quantitatively assess postural alignment in both frontal and sagittal planes, as well as pain in children and adolescents victims of burn injuries. [Subjects and Methods] This cross-sectional study included 21 victims of burns, nine children (age [mean ± SD], 7.3 ± 1.1 yrs) and 12 adolescents (12.0 ± 1.4 yrs), classified as medium and large burns, being investigated on pain and postural alignment evaluated by photogrammetry. Pain intensity was assessed by face scales and postural examination included the assessment of global and thoraco-lumbo-pelvic alignment by previously designed protocols. [Results] Only two adolescents reported mild pain associated with burn injuries, whereas deviations of the projection of the gravity center, forward head posture, and scapular asymmetry were observed in both groups. In the analysis of the thoraco-lumbo-pelvic alignment, children tended to have anterior inclination trunk, increased thoracic kyphosis and lumbar lordosis, while in adolescents, increased thoracic kyphosis and lumbar lordosis were observed. [Conclusion] The results indicate that due to the postural alterations and asymmetries in both frontal and sagittal planes, there is an increased risk of developing scoliosis and possible future pain. Thus, physiotherapy is indicated and should be maintained until complete growth is reached.

Key words: Burns, Physical Therapy Specialty, Posture

INTRODUCTION

Burns are considered a major health problem especially in low and middle income countries where more than 95% of deaths caused by burns occur1). Children and adolescents are frequently affected by burns and physical and psychological consequences are more intense by reason of growth and development2). Furthermore, possible sequelae may reduce self-esteem and bring functional limitations in the long term3). Most accidents are caused by contact with fire, overheated liquids and surfaces, smoke inhalation, chemical, electrical or radioactive burns4). First-degree burns may be managed in emergency rooms, while second-degree ones require a specialist evaluation for possible excision and grafting5). According to Berman et al.6), the healing phase may last up to two years, and this is a critical period in which keloids and hypertrophic scars may form, as well as chronic pain associated to burn injuries5). Burn complications include musculoskeletal consequences that may occur in the first weeks or take years after the injury, affecting life quality substantially9).

Thus, due to broad implications of burns it is crucial that the entire medical team involved in the treatment use valid, sensitive and reliable measurement tools, in order to optimize the results, clinical management, and the performance of clinical research10, 11). Physiotherapy is important throughout the entire rehabilitation process, as it helps patients to reach optimal functional results whilst maintaining adequate posture, which is an essential part of the therapeutic goals11). Postural evaluation by placing markers in specific anatomical regions, and later photographic analysis has been widely used to quantitatively assess different populations12, 13, 20). Concerning victims of burns, postural complications have been sub-reported in literature and there is a lack of studies that evaluate those complications objectively. Therefore, the goal of this study is to quantitatively evaluate the pain and the postural alignment of children and adolescents victims of burn injuries in order to provide resources to prevent further postural alterations and possible sequelae, giving support to long-term care.

SUBJECTS AND METHODS

This is a cross-sectional study carried out in children and adolescents victims of burns, in the period of six months to two years after hospital discharge. All patients that returned...
to the ambulatory care unit of the Burn Injuries Treatment Center (BTC), during the period of data collection were evaluated. The study has been approved by the Ethics and Research Committee involving human beings of the institution. All participants and their parents gave written informed consent before the study.

The study was carried out from October 2013 to July 2014. It included children and adolescents victims of burn injuries according to the programmed outpatient return. The inclusion criteria were: the victims should be between six to 14 years old, with burn injuries diagnosis, had been discharged from hospital for a period of time between six months to two years. The exclusion criteria were: presence of sensorial deficiency; inability to stand without external assistance; chronic or acute musculoskeletal diseases; previous sequelae; unhealed wounds.

The data regarding the hospitalization period was collected through a study of patient records, and information regarding the outpatient physical care was obtained through interviews with the participants and their parents or legal guardians at the time of collection. To investigate pain intensity, face scales developed by Claro14, were applied—a simple tool focused on the children population. The participants reported pain when choosing among five facial expressions available—being zero the value equivalent to pain absence, one referring to mild pain, two for moderate pain, three for severe pain and finally four for unbearable pain14. Moreover, patients were asked to report the exact location of pain, and if it was related to the burn.

Evaluations were performed at the BTC ambulatory room, and patients were prepared by one physiotherapist trained to mark anatomical points, through location tutorial, elaborated by Ferreira15 for the standardization of photograph; furthermore they were asked to remain barefoot (model COOLPIX P510), aluminum tripod-Tron® (model vpt-10). To obtain standardized images, ground markings were done so that the camera could be adequately positioned on the tripod at the height of 90 cm from the ground and at a distance of 3 m between the center of the camera and the wall. A non-reflective black cloth was placed to the wall and a 30 × 35 cm ethyl vinyl acetate mat was nailed on the floor at a distance of 15 cm from the wall.

To collect the images, participants were instructed to remain in the standing position on the mat, in their usual and comfortable posture, with feet slightly apart, weight evenly distributed, and a straightforward look10. The materials used were: 15 mm white styrofoam balls for the marking of anatomical points; 8 mm diameter and 5.5 cm in length plastic rods for the marking of the spinous processes for better side viewing; all fixed with double-sided adhesive tape (Fig. 1). Photograph analysis was conducted according to the following procedure: Stock photography opening at 100% zoom, image calibration, marking of points following the SAPO protocol (Table 1). For analysis in the sagittal view, the SAPO program proved to be a feasible and reliable quantitative method once there was high agreement values of all measurements performed by three different examiners (no ICC was less than 0.80)18. Photograph analysis was conducted according to the following procedure: Stock photography opening at 100% zoom, image calibration, marking of points following the SAPO protocol (Table 1). For analysis in the sagittal view Perry et al.19 recommend the use of easily palpable anatomical regions and the largest distance between the anatomical markers in order to maximize reliability. Thus, three angular measurements were obtained to describe the thoraco-lumbar-pelvic alignment, with the method based on the studies by Perry et al.19, Smith; O’Sullivan; Straker20, Smith et al.21, and Camargo22: 1. Trunk angle: formed between C7 to T12 and T12 to the greater trochanter (posterior angle of intersection); 2. Lumbar angle: between the line of T12 to the ASIS and ASIS to the greater trochanter (posterior angle); and 3. Sway angle: between C7 line to the greater trochanter and the greater trochanter to the lateral malleolus. The inclination to the right and left are expressed by signals, the positive value being used to express the anti-clockwise and the negative one for clockwise23, 24. Following the study, a written feedback of the results evaluation and referrals was given to
Table 1. Measures used by the protocol of the SAPO software

| Anterior view |
|---------------|
| Head          |
| A1- horizontal alignment of the head |
| Trunk         |
| A2- horizontal alignment of the acromion |
| A3- horizontal alignment of the ASIS |
| A4- angle between the two acromia and the two ASIS |
| Lower limbs   |
| A5- frontal angle of the right lower limb |
| A6- frontal angle of the left lower limb |
| A7- difference in lower limb length: right - left sides |
| A8- horizontal alignment of the tibial tuberosities |
| A9- right Q angle |
| A10- left Q angle |

| Left lateral view |
|-------------------|
| Head              |
| A11- horizontal alignment of the head (C7) |
| Trunk             |
| A13- vertical alignment of the trunk |
| A14- hip angle (trunk and lower limb) |
| A15- vertical alignment of the body |
| A16- horizontal alignment of the pelvis |
| Lower limbs       |
| A17- knee angle |
| A18- ankle angle |

| Posterior view |
|----------------|
| Trunk          |
| horizontal asymmetry of the scapula in relation to T3 |
| Lower limbs    |
| A19- leg/right hindfoot angle |
| A20- leg/left hindfoot angle |

ASIS: anterior superior iliac spines; C7: seventh cervical vertebrae; T3: thirteen thoracic vertebrae

RESULTS

We evaluated 21 children and adolescents victims of burn injuries, at the age [mean ± SD], 10.0 ± 2.7 years, 16 males and five females, nine children (7.3 ± 1.1 years) and 12 adolescents (12.0 ± 1.4 years) with 12.7 ± 5.5 months after hospital discharge. All children reported no pain at the time of evaluation and two teenagers reported mild pain associated with the burns (Table 2). The values obtained by the SAPO protocol with the anterior, lateral and posterior left views are shown in Table 3. Sagittal plane data were presented only on the left side view, since there was no statistically significant difference between the values obtained by analysis of the right and left lateral view. The analysis of the values obtained by the thoraco-lumbo-pelvic alignment is shown in Table 4.

Most children and adolescents values obtained through the SAPO protocol were different from the reference values, moreover head and trunk alignment discrepancies for head, trunk and deviation of the CGP were observed in both groups. There were no statistically significant differences between children and adolescents values in the thoraco-lumbo-pelvic alignment analysis.

DISCUSSION

The present study assessed 21 children and adolescents, classified as medium and large burns; of these, only two teenagers reported mild pain associated with the burns. The group consisting of adolescents showed higher body surface area burned, and underwent a bigger number of surgical procedures when compared to the children’s group. This shows that, in some teenagers, even six months after hospital discharge, there could be pain associated with burns. One could note that in the study by Schneider et al.,26) the frequency and intensity of pain were reduced within two years after the burn, however it was still present in children victims of burns. In the outpatient setting, the presence of pain related to burning should be considered in treatment planning.

Ferreira et al.,21) used zero as parameters for the horizontal alignment of the head, acromion, pelvis (ASIS) and trunk (angle between acromion and ASIS). In this study, the measures that represent these parameters are, respectively, A1, A2, A3 and A4. When analyzing these results children and adolescents had similar values which were close to zero; except for the pelvis which were significant difference between the groups, with children presenting pelvic inclination more frequent on the left (high right pelvis), unlike adolescents who had a higher frequency of inclination to the right (higher left pelvis) and more distant values of zero. Such values are identified when facing the CGP, in which such projection in the frontal plane, showed no statistically significant difference between groups. Children had a higher frequency of weight transfer to the left and adolescents to the right, with more distant values of zero as well.

Schneider and Qu8) highlighted that the asymmetric burns in the trunk, hips and shoulder girdle can lead children to favor the affected side, that is, an inclination towards the burned area. Quiu et al.,27) also reported that wound contracture, in the trunk can lead to imbalance in the lateral-spine. In this context, most children and adolescents had their trunks affected by the burn and in accordance with Quiu et al.,27) it was possible to verify the lateral deviation in both groups, as well as the individual analysis made it possible to notice the asymmetry of the injury, however, it was not possible to notice the detection of any pattern to explain the difference in weight transfer between the groups. For the analysis of the lower limbs no significant difference was observed, as well as in the analysis of the difference of length of the lower limbs (A7), the average values were close to zero. Simultaneously, when considering the alignment of tibias (A8), both in children and adolescents value zero suggests horizontal alignment, as for the frontal angle (A7 and A8). The only reference values, defined at the SAPO report are the measures for the Q (A9 and A10) angle, whose reference value is of 15°, thus, the values obtained in this sample are close not only to the reference value but also to the values...
In the lateral view, the vertical alignment of the head was the only value that presented a statistically meaningful difference among the groups, but there are no normality parameters for the studied age. In clinical practice, when analyzing the points that make up the A12 angle, it is possible to infer that the further tragus is in relation to the acromion the biggest the positive value of this angulation, thus, both forward head and shoulder protrusion, could change such angulation, and it is what makes difficult to interpret this meaningful difference between the groups. The angle that represents the head positioning in relation to the neutral or anterior position is the C7, ear lobe and the horizontal alignment of the head (A11), based on this angle the study carried out with adolescents by Ruivo, Pezarat-Correia and Carita28), established that the values smaller than 50° indicate forward head posture and therefore, it may be said that in the current study, both children and adolescents presented forward head posture. When analyzing the projection of the CG in the sagittal plane, it can be observed that children and adolescents have body weight forwardly distributed. For other angular values no references in the literature was found regarding the studied age group. In posterior view, Ferreira et al.23) considered zero value in the scapular alignment in relation to T3, having found an average value of 0.5 that differs from the one found in our study, in which, the results suggest scapular asymmetry that occurred in almost 77% of children and 83% of adolescents from this study.

SAPO protocol has restricted information about the thoraco-lumbo-pelvic alignment, therefore this study used the methodology described in the study by Perry et al.19), which when analyzing the reliability of photographic analysis of the standing posture in the sagittal plane in adolescents, found excellent intra-examiner (ICC = 0.99 for the three angles, with standard error of 0.2 for the angle of body inclination and 0.4 for the angles of the trunk and lumbar), thus suggesting a good reproducibility test. As for the inter-rater reliability analysis, these same measures varied from poor to reasonable suggesting that factors such as the placement of markers, setting parameters, body positioning, and biological variability, may have led to lower reliability.

For the interpretation of the measures obtained from the thoracic lumbar-pelvic alignment in children the study used was the one from Camargo22), which presented as values: the average of inclination angle of 163.4 ± 4.8; trunk angle of 203.1 ± 7.9 and lumbar angle of 87.5 ± 8.8. In the present study the reported values were: 159.1 ± 2.2 for the inclination angle, 199.7 ± 1.6 for the trunk angle and 83.8 ± 2.4 for the lumbar angle.
study it was possible to observe that, children presented a bigger inclination angle (tendency to anterior inclination of the trunk) with a bigger trunk angle (thoracic kyphosis); and a smaller lumbar angle (increased lumbar lordosis). As for the adolescents the study by Smith et al.21), was used as reference, being considered: neutral inclination angle of 166.5 ± 4.2; neutral trunk angle of 201.7 ± 6.1 and neutral lumbar angle of 86.5 ± 6.9. In the present study, it was found that adolescents had inclination angle within the considered neutral position; however, with increased thoracic kyphosis and increased lumbar lordosis. It is important to highlight the fact that about 33% of children and 75% of adolescents had burns involving face and/or cervical; and 44% of children and 58% of adolescents had the anterior trunk affected. Schneider e Qu 8), point out that burns in childhood, in anterior cervical and thoracic region can lead to anterior shoulder and kyphotic posture, along with a protection posture. Furthermore, wound contracture in burned patients, in the trunk region, may biomechanically induce to increased lordosis, depending on the affected region27).

One limitation of the study is the reduced number of samples, due to the difficulty of recruiting subjects, as the

Table 3. Values obtained through the SAPO protocol and comparasion between children and adolescents

| Measure | Children (N=9) | Adolescents (N=12) | Reference (SAPO protocol) |
|---------|----------------|-------------------|---------------------------|
| Anterior |                |                   |                           |
| Head    | A1 1.3 [-3.4 to 3.4] | 1.5 [0.3 to 6.6]  | 0                         |
| Trunk   | A2 -0.9 [-2.1 to 1.1] | 1.7 [0.0 to 3.2]  | 0                         |
|         | A3 -1.0 [-2.4 to 0.0] | 1.0 [0.0 to 3.7]  | *                         |
|         | A4 0.0 [-1.8 to 3.7]  | 0.1 [-1.2 to 2.5] | 0                         |
| Lower   | A5 -0.4 [-1.6 to 1.1] | -0.6 [-3.2 to 0.0] | NA                       |
| Limbs   | A6 -1.0 [-1.8 to 0.2] | 0.0 [-1.5 to 1.7] | NA                       |
|         | A7 0.6 [-0.7 to 1.3]  | -0.6 [-1.3 to 0.4] | NA                       |
|         | A8 0.0 [-1.6 to 0.0]  | 0.0 [-1.4 to 1.5] | 0                         |
|         | A9 10.5 [7.5 to 19.9] | 13.8 [10.9 to 15.8] | 15                       |
| Limbs   | A10 20.2 [19.4 to 24.3] | 16.6 [8.4 to 24.8] | 15                       |
| Left lateral view |              |                   |                           |
| Head    | A11 49.9 [42.8 to 54.3] | 48.5 [43.4 to 54.0] | NA                       |
|         | A12 12.3 [9.2 to 18.9] | 21.4 [14.2 to 26.4] | *                         |
| Trunk   | A13 -6.4 [-6.9 to 1.7] | -5.7 [-8.9 to -0.1] | NA                       |
|         | A14 -12.0 [-15.8 to -4.8] | -10.9 [-16.6 to -5.7] | NA                       |
|         | A15 0.2 [-0.7 to 1.2]  | 1.0 [-0.5 to 3.8]  | NA                       |
|         | A16 -16.4 [-18.6; -8.2] | -15.3 [-19.7 to -9.3] | NA                       |
| Lower   | A17 -5.3 [-9.5 to -1.5] | -1.4 [-5.2 to 5.2]  | NA                       |
| Limbs   | A18 90.0 [87.2 to 93.2] | 86.4 [80.1 to 89.5] | NA                       |
| Posterior |                 |                   |                           |
| Trunk   | Assim -6.9 [-18.5 to 7.4] | 2.0 [-15.6 to 10.8] | 0                         |
| Lower   | A19 13.7 [4.3 to 15.8] | 6.0 [2.1 to 9.0]  | NA                       |
| Limbs   | A20 11.1 [4.3 to 12.8] | 6.2 [2.4 to 12.2] | NA                       |
| CGP- frontal plane (%) | -5.8 [-15.3 to 4.8] | 8.6 [-8.7 to 20.0] | 0                         |
| CGP- sagittal plane (%) | 22.1 [16.2 to 27.3] | 36.1 [19.0 to 39.8] | 0                         |

*p< 0.05; median [25 to 75%]; Positive values indicate tilt to the right and negative to the left; Assim: horizontal asymmetry of the scapula in relation to T3; CGP: Center of Gravity Projection; NA: Not available

Table 4. Values obtained by analyzing the thoraco-lumbo-pelvic region and comparasion between children and adolescents

| Measures | Children (N=9) | Adolescents (N=12) |
|----------|----------------|-------------------|
| Trunk Angle | 207.1 [203.7 to 211.8] | 205.8 [203.2 to 211.0] |
| Lumbar Angle | 86.6 [82.4 to 89.1] | 83.5 [82.1 to 85.4] |
| Sway Angle | 166.0 [164.0 to 167.6] | 166.5 [165.2 to 167.1] |

*p> 0.05; median [25 to 75%]
BTC is a reference center for treating victims of burns, most of the individuals did not attend the outpatient return due to transportation problems. We point out the difficulty in comparing the results with those found in the literature by using different methodologies and the lack of normal reference values for the age range considered.

This study highlights some considerations for further research, such as psychological aspects, which was not investigated. Prykora et al.\(^2\) argues that extensive burns are considered great physical and psychological traumatic events in the life of children. Some studies have been conducted to verify the reciprocal association between emotional state and posture\(^3\). As for the clinical implications, the study demonstrates the need for more careful attention to the postural aspect in pediatric burn victims after hospital discharge, since it was observed as in children and adolescents with multiple affected body regions as in those with injuries in only one segment, postural deviation in both planes—the frontal plane, with greater weight transfer on one side and/or scapular asymmetry; as the sagittal plane, with changes in segments of the head and/or thoracic region and/or lumbar region. These results indicate that, in this specific population, there is an increased risk for the development of pain and even future scoliosis, requiring postural monitoring until the end of the growth period.

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**REFERENCES**

1. World Health Organization (WHO): A WHO plan for burn prevention and care. Geneva, Switzerland, 2008. \[Medline\]  
2. Stubbs TK, James LE, Daugherty MB, et al.: Psychosocial impact of childhood face burns: a multicenter, prospective, longitudinal study of 390 children and adolescents. Burns, 2011, 37: 387–394. \[Medline\]  
3. Davoodi P, Fernandez JM, O SJ: Postburn sequelae in the pediatric patient: clinical presentations and treatment options. J Craniofac Surg, 2008, 19: 1047–1052. \[Medline\]  
4. Forjuoh SN: Burns in low- and middle-income countries: a review of available literature on descriptive epidemiology, risk factors, treatment, and prevention. Burns, 2006, 32: 529–537. \[Medline\]  
5. Lloyd EC, Rodgers BC, Michener M, et al.: Outpatient burns: prevention and care. Am Fam Physician, 2012, 85: 25–32. \[Medline\]  
6. Berman B, Viera MH, Amini S, et al.: Prevention and management of hypertrophic scars and keloids in children after burns in children. J Craniofac Surg, 2008, 19: 989–1006. \[Medline\]  
7. Wiechman SA: Psychosocial recovery, pain, and itch after burn injuries. Phys Med Rehabil Clin N Am, 2011, 22: 327–345, vii. \[Medline\]  
8. Schneider JC, Qu HD: Neuropsychologic and musculoskeletal complications of burn injuries. Phys Med Rehabil Clin N Am, 2011, 22: 261–275, vi. \[Medline\]  
9. Heath K, Timbrell V, Calvert P, et al.: Outcome measurement tools currently used to assess pediatric burn patients: an occupational therapy and physiotherapy perspective. J Burn Care Res, 2011, 32: 600–607. \[Medline\]  
10. Ali ZM, El-Refay BH, Ali RR: Aerobic exercise training in modulation of aerobic physical fitness and balance of burned patients. J Phys Ther Sci, 2012, 24: 391–394. \[CrossRef\]  
11. Serghiou M, Cowan A, Whitehead C: Rehabilitation after a burn injury. Clin Plast Surg, 2009, 36: 675–686. \[Medline\]  
12. Shaleen AA, Basuodon RM: Quantitation assessment of head posture of young adults based on lateral view photographs. J Phys Ther Sci, 2012, 24: 391–394. \[CrossRef\]  
13. Nam SH, Son SM, Kwon JW, et al.: The intra- and inter-rater reliabilities of the forward head posture assessment of normal healthy subjects. J Phys Ther Sci, 2013, 25: 737–739. \[Medline\]  
14. Claro MT: Escala de faces para avaliação da dor em crianças: etapa preliminar. Dissertação (Mestrado)-Escola de Enfermagem de Ribeirão Preto, Universidade de São Paulo. São Paulo: Ribeirão Preto, 1993. p 50.  
15. Ferreira EA: Postura e controle postural: desenvolvimento e aplicação de método quantitativo de avaliação postural. [Tese]. São Paulo: Faculdade de Medicina, Universidade de São Paulo, 2005. p 114.  
16. Delphi M, Cagne B, Coorevits P, et al.: Classification system of the normal variation in sagittal standing plane alignment: a study among young adolescent boys. Spine, 2013, 38: E1003–E1012. \[Medline\]  
17. Ferreira EA, Duarte M, Maldonado EP, et al.: Postural assessment software (PAS/SAPO): validation and reliability. Clinics (Sao Paulo), 2010, 65: 675–681. \[Medline\]  
18. Santos MM, Silva MP, Sanada LS, et al.: Photogrammetric postural analysis on healthy seven to ten-year-old children: interrater reliability. Rev Bras Fisioter, 2009, 13: 350–355. \[CrossRef\]  
19. Perry M, Smith A, Straker L, et al.: Reliability of sagittal photographic spinal posture assessment in adolescents. Adv Physiotherapy, 2008, 10: 66–67. \[CrossRef\]  
20. Smith A, O’Sullivan P, Straker L: Classification of sagittal thoraco-lumbar-pelvic alignment of the adolescent spine in standing and its relationship to low back pain. Spine, 2008, 33: 2101–2107. \[Medline\]  
21. Smith AJ, O’Sullivan PB, Beales DJ, et al.: Trajectories of childhood body mass index are associated with adolescent sagittal standing posture. Int J Pediatr Obes, 2011, 6: e97–e106. \[Medline\]  
22. Camargo MZ: Postura e obesidade infantil: análise do alinhamento no plano sagital em pré-escolares. [Tese] Universidade Estadual de Londrina, Londrina. 2013. 60f.  
23. Ferreira EA, Duarte M, Maldonado EP, et al.: Quantitative assessment of postural alignment in young adults based on photographs of anterior, posterior, and lateral views. J Manipulative Physiol Ther, 2011, 34: 371–380. \[Medline\]  
24. Souza JA, Pasinato F, Basso D, et al.: Biophotogrammetry: reliability of measurements obtained with a posture assessment software (SAPO). Rev Bras Cineantropom Desempenho Hum, 2011, 13: 299–305.  
25. WHO, World Health Organization: Adolescent health. http://www.who.int/topics/adolescent_health/en/ (Accessed Jun. 22, 2014).  
26. Schneider JC, Nadler DL, Herndon DN, et al.: Pruritus in pediatric burn survivors: defining the clinical course. J Burn Care Res, 2015, 36: 151–158. \[Medline\]  
27. Qiu Y, Wang SF, Wang B, et al.: Adolescent scar contracture scoliosis caused by back scalding during the infancy period. Eur Spine J, 2007, 16: 1557–1562. \[Medline\]  
28. Ruivo RM, Pezarat-Correa P, Carita AI: Cervical and shoulder postural assessment of adolescents between 15 and 17 years old and association with upper quadrant pain. Braz J Phys Ther, 2014, 18: 364–371. \[Medline\]  
29. Przkora R, Barrow RE, Jeschke MG, et al.: Body composition changes with time in pediatric burn patients. J Trauma, 2006, 60: 968–971, discussion 971. \[Medline\]  
30. Oosterwijk S, Rotteveel M, Fischer AH, et al.: Embodied emotion concepts: how generating words about pride and disappointment influences posture. Eur J Soc Psychol, 2009, 39: 457–466. \[CrossRef\]