IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 5, Issue 5 Ver. VI (Sep. - Oct. 2016), PP 24-36
www.iosrjournals.org

Effect of Sensory and Motor Stimulation Program on Clinical Outcomes of Patients with Moderate Head Injury

Zienab A. Alam[1], Om Ebrahiem E. Elsaay[2],Soheir M. Weheida[3], Hend M.Elazazy[4],Safaa E. Ahamed[5]

[1]*Assist. Lecturer of Critical Care Nursing-Faculty of Nursing- Tanta University, Egypt*
[2]*Assist. Prof. of Medical Surgical Nursing- Faculty of Nursing- Tanta University, Egypt*
[3]*Prof. of Medical Surgical Nursing, Faculty of Nursing, Alexandria University, Egypt*
[4]*Assist. Prof. of Medical Surgical Nursing- Faculty of Nursing- Tanta University,Egypt, Assist. Prof. of Medical Surgical Nursing, KSAU, KSA*
[5]*Lecturer of Critical Care Nursing- Faculty of Nursing- Tanta University, Egypt*

Abstract: *Sensory and motor stimulation are the systematic exposure of a comatose or minimally conscious patient with head injury to a variety of environmental stimuli (visual, auditory, tactile, olfactory, and kinesthetic) to improve arousal, and level of consciousness. Aim of the present study was to determine the effectiveness of sensory and motor stimulation program on clinical outcomes of patients with moderate head injury. Material and method: The study was conducted at intensive care unit at Tanta Emergency Hospital affiliated to Tanta University.A sample of 60 adult patients with moderate head injury were selected and divided randomly and alternatively into two equal groups: Group I: received sensory and motor stimulation program. Group II: received hospital routine of care for patients with moderate head injury. Two tools were used in order to collect the necessary data; Tool 1: Brain Injury Patients Assessment Tool and. Tool II: Head Injury Clinical Outcome Assessment Tool. Results: the main result revealed that there was a significant improvement of levels of consciousness, cognitive and sensory functions post implementation of sensory and motor stimulation program for patients in the study group than control group. Also, the current study showed that about two third (60.0%) of study group had shorter duration of stay in ICU (15-20 days), compared to (33.3%) of control groups and there was a positive significant correlation between total Rancho Los Amigo and total GCS scores in the 2nd week and one month later of the study group. Conclusion and recommendation: application of sensory and motor stimulation program improves clinical outcomes and decrease length of hospital stay of moderate head injury patients in combination of pharmacological intervention. It was recommended that institutional written policy and guidelines should be available regarding application of sensory and motor stimulation as a daily routine care for patients with moderate head injury.*

Keywords: *Sensory and motor stimulation, clinicaloutcomes, moderatehead Injury*

I. Introduction

Head injury is a serious public health problem worldwide with an estimated 5 million deaths annually. Moreover, the incidence of traumatic injuries particularly road traffic accidents (RTAs) and workplace related injuries are rising throughout the world wide. Moreover, the numbers of temporary or permanent disabilities due to traumatic head injury (TBI) are also accounted in millions (1, 2).

Head injury is a serious public health problem in Egypt under peace or violent conditions. Like developed countries, there is not well-established system for collecting and managing information on various diseases in Egypt (3). It is a daunting task to obtain reliable information about acquired brain injury. Updated statistical records about TBI in Egypt are lacking. Review of Tanta Main University Hospital Statistical Records has recorded that 2800 patients with head injury were admitted to Tanta Emergency Hospital from May 2012 to June 2016(4).

Head injury patients with altered level of consciousness experience sensory deprivation because their ability to respond to internal and external stimuli is altered threshold of activation of reticular activating system may increase in coma patients (5-7).Therefore, environmental or sensory and motor stimulation can be used as an intervention to overcome of sensory deprivation and may improve brain function and plasticity (8-11). Application of sensory and motor stimulation for head injury patients in a systematic manner may improves the brain organization, and functional activity. The rationale is that exposure to sensory stimulation will facilitate both dendrite growth and improve synaptic connectivity for head injury patients with damaged nervous systems leading to improved cognitive functioning and environmental interaction(12). Sensory stimulation; is a systematic exposure of a comatose or minimally conscious patient with head injury to a variety of environmental stimuli (visual, auditory, tactile, olfactory, and kinesthetic) to improve arousal and recovery (11,

12). Motor or kinesthetic stimulation considered as a part of structured environment stimulation. It is a pattern of simple physical rehabilitation in intensive care unit performed through passive or active range of motion exercises and bed movement activities (5, 6).

Application of sensory and motor stimulation program for patients with moderate head injury is found to be feasible, safe, did not increase costs, and is associated with decreased intensive care unit and hospital length of stay. Moreover; sensory and motor stimulation program is arouse the brain by stimulating the reticular activating and increasing the level of cognitive function (8).

The rehabilitative care for patients with a head injury is a significant challenge for nurses as they are responsible for all patients' care. The critical care nurse role regarding application of sensory and motor stimulation program for head injury patients organized into four phases; assessment, planning, implementing and evaluation (5, 9, 10).

So the critical care nurse play a more active and meaningful role through application of rehabilitative care and stimulating program into the conventional care for patients with altered level of consciousness to enhance recovery(12).

Aim of the study

The aim of this study is to evaluate the effect of sensory and motor stimulation program on clinical outcomes of patients with moderate head injury.

II. Materials and method

Study design

The present study was a quasi- experimental research design.

Setting

The study was conducted at Anesthesia Intensive Care Unit at Tanta Emergency Hospital affiliated to Tanta University, Gharbia governorate, Arab Republic of Egypt. The capacity of this setting is 20 beds.

Sample

Apurposive sample of60 adult patients with moderate head injury was selected based on Epi. Info and the sample was divided randomly and alternatively into two equal groups; 30 patients each as follow.

Group I (Study group): Received sensory and motor stimulation program.

GroupII (Control group): Received hospital routine of care for patients with moderate head injury.

Patients enrolled in the study according to the following inclusion criteria; adult patients ranging from 21-60 years old, both sex,newly admitted within72 hours to intensive care unit, the Glasgow Coma Scale (GCS) score between 9 and 12 and hemodynamic stable.

Patients who havea history of brain injury, seizure and blindness were excluded from thesample.

Tools:

Two tools were used to collect data related to the study purpose as follow

Tool 1: Brain injury'patientsassessment Tool.

This tool was developed by the researchers based on relevant literature review (5-7, 13-15) and consisted of three parts:

Part (1): Biosociodemographic data to assess patient code, age, sex, marital status,educational level, occupation, date of admission, past and present medical and surgical history and duration of stay in intensive care unit.

Part (2): Physiological parameters: which include monitoring of pulse rate, blood pressures, body temperature, mean arterial pressure, oxygen saturation, respiratory rate, central venous pressure and blood glucose level.

Part (3): Neurological assessment: it includes:oculomotor papillary response, cranial nerves assessment and upper and lower limbs movements.

Tool II: Head injury; clinical Outcome assessment tool;to assess level of consciousness, sensory and cognitive functions and physical activity of head injured patients. It was consisted of 4 parts as follow:

Part (1) Glasgow Coma Scale

This scale was developed by (Teasdale and Jennett, 1974)(15) to assess neurological function and level of arousal. The scale is based on the numerical value assigned to an individual's eye opening, verbal and motor responses. Each response is scored separately and then totaled. Total scores ranged from 3 to 15, with score 3 indicating severe neurological deficits (deep coma) and score 15 representing no deficits (awake, alert, and oriented)(15, 16).

Part (2): Sensory Modality Assessment and Rehabilitation Technique (SMART).

It was developed by (Gill-Thwaites&Munday, 1999)(17) to provide a structured and graded assessment of sensory, motor responses and communicative function of comatosed patients in response to stimulation.

The sensory assessment has 8 modalities including the 5 sensory modalities (visual, auditory, tactile, olfactory, and gustatory) also motor function communication and wakefulness/arousal.The SMART's 5 point hierarchical scale is consistent and comparable across all of the sensory modalities. The five levels range from 'no response' (level 1), 'reflexive' (level 2), 'withdrawal' (level 3), 'localizing' (level 4) and 'discriminating' responses (level 5). The total scores ranged from 8 to 40, with score 8 indicating severe deficit of sensory function and score 40 representing no deficit.

Part (3); Chelsea Critical Care Physical Assessment Tool: This tool was developed by (Corner EJ, et al,2012)(18)to provides a structured and graded assessment of physical function for patients in intensive care unit and considered as functional assessment scale in a general intensive care unit(19). It is composed of ten items; respiratory function ,cough, bed mobility, supine to sitting on the edge of the bed, dynamic sitting, sit to stand, standing balance, transferring from bed to chair and stepping, as well as grip strength.

Each component is graded on a six-point from 0 to 5 ;where 0 denotes complete dependence and 5 denotes complete independence giving an overall score out of 50.

Part (4): Rancho Los Amigos Levels of Cognitive Functioning Scale (LCFS).

This scale developed by (Hagen et al, 1972)(20) to assess individual's cognitive function of patient who had traumatic brain injury, based on behavioral presentations.

A score of one represents non-responsive cognitive functioning, whereas a score of eight represents purposeful and appropriate functioning.

Scoring system based on combinations of the following criteria; responsiveness to stimuli, ability to follow commands, presence of non-purposeful behavior, cooperation ,confusion, attention to environment ,focus, coherence of verbalizations, appropriateness of verbalizations and actions, memory recall ,orientation, judgments and reasoning.

III. Method

Administrative process

Written approval: Hospital permission was obtained from the responsible authority of Tanta Emergency Hospital affiliated to Tanta University and critical care unit before conducting this study through official letters from Faculty of Nursing explaining the purpose of the study.

Tool development:

Tool I Brain injury patients' assessment tool: was developed by the researcher based on relevant literature review and was consisted of three parts:

Tool II: Head injury clinical outcome assessment toolPart (3); (Chelsea Critical Care Physical Assessment Tool) was adapted and translated to Arabicby the researcher after reviewing of expertise

Content validity: All tools were tested for content validity by 10 experts in the field of medical-surgical and critical care nursing, Faculty of Nursing, anesthesiologist,Faculty of Medicine and accordingly some modifications were done

Reliability: All tools were tested for reliability and Cronbach alpha was used based on standardized items and it was 0.761 and0.837 respectively for tool I and II

A pilot study

A pilot study was carried out on 6 patients with moderate head injury in order to test the clarity, feasibility and applicability of the different items of the determinant tools and accordingly;some modifications were done and those patients were excluded from the study.

Data was collected from the end of June 2014 to the end of April 2016.

Verbal and written consent was obtained from the patients' family to participate in the study after explaining the purpose of the study and their right to refuse participation or withdrawn from the study at any time.

Confidentiality and privacy were assured.

Phases of the actual study: The present study was conducted on four phases.

1. Assessment phase:-

Immediately upon admission; initial assessment was carried out by the researcher for all study subjects in both control and study groups to assess the patients who met the inclusive criteria of the study. Assessment was carried out using tool (I) and tool (II) to collect baseline data.

2. Planning Phase:

This phase was formulated based on assessment phase and literature review. Priorities and expected outcome criteria were put when planning of patient care which included: an improvement of Glasgow coma score, Rancho los amigo score SMART score, and decreased the length of ICU stay. In this phase, a colored booklet was developed by the researcher to be distributed to each patient'family in the study group to be considered as a reference value for the study group patients and their families.

3. Implementation phase:

Group I (Study group):

In this phase the sensory and motor stimulation program was implemented by the researcher to all participants involved in the study group.

A-Sensory stimulation was arranged in a way that each patient received sequential stimulation of all five sensory modalities each day, with each session lasting 30 -45 minutes, for 14 consecutive days.The stability of patients condition was confirmed by stable vital signs indicated by body temperature (T) 36.5 to 37.5°C; pulse rate (P) 60-100 times/min; respiratory rate 12-20 cycle/min; blood pressure 100-130/80-90 mmHg; and oxygen saturation ≥ 95%(5-7,13-15).

In order to avoid possible sensory overload among the persons with head injury, the program was first provided with the routine nursing care with closed monitoring for physiological responses through vital signs and oxygenation status.

The researcher prepare the patient room through decrease number of visitors, close the door and maintain a good odor in the room before starting the stimulation.

The researcher placed the patient in comfortable position (semi sitting position) if permitted before starting the stimulation.

The researcher aroused person at beginning of session to ensure optimal benefit and responsiveness through talking to the patient slowly, in a normal tone of voice and oriented patient to the date, time, and place before implementation the program.

The researcher provided stimulation to all senses, but target only one modality at a time (no talking while providing stimulation) and presented each stimulus a minimum of 3 times.

Family members involved during application visual and auditory stimulation with the researcher.

Rest period was given to the patient 1-2 minutes between each stimulus.

Visual stimulation; was applied by stimulating the usual attention and tracking eyes to visual stimulus as colored pen light, familiar faces or objects, photographs of family members and a mirror.

Auditory stimulation; was performed through starting conversation with patient, oriented about his or her name, time, place date and day.

Tactile stimulation; stimulationof all types of tactile receptors (temperature, light and deep touch, and pressure) was provided for 10 minutes each session.

Oral stimulation was applied during routine mouth care, unless patient demonstrates a bite reflex. The protocol included irrigation of the oral cavity, gum massage, and finished by taste stimulation

Olfactory stimulation was performed with aromas to which patient had been accustomed were applied. Example of these stimuli were patient' favorite fragrance such as herbs,orange or lemon peels, coffee or hot tee, favor extract (i.e. Vanilla), fragrance of soap, cologne or perfume for 2 minutes.

B-Motor stimulation was begun early after hemodynamic stability of patients, it begun with passive or active and, may progress to include sitting of bed to chair transfers. It was arranged that each patient received range of motion exercises for upper and lower limps each day with each session lasting 10 minutes, for 14 consecutive days.

2-Group II (Control group): received routine hospital care for patients with moderate head injury

4. Evaluation phase:

Evaluation was done for both groups four times;on admission as baseline data, after one week, then second week and one month later using tool I, II.

Comparison was done between both groups to determine effect of motor and sensory program on clinical outcomes of patients with moderate head injury

Statistical analysis

The collected data were organized, tabulated and statistically analyzed using SPSS software statistical computer package version 13. For qualitative data, comparison between two groups and more was done using Chi-square test ($\chi 2$). For comparison between means of two groups of parametric data; Student t-test was used and paired t-test was used for comparing means of one group before and after intervention. Correlation between variables was evaluated using Pearson's correlation coefficient. Significance was adopted at $p<0.05$ for interpretation of results of tests of significance (21, 22).

IV. Results

The result of the present study revealed thatmore than one third of study and control group (43.3% and 33.3%respectively) were in age group of 21 to 30 years. **In relation to sex**; it was found that more than two third (70.0%) of study group followed by 60% of control group were male andthe highest proportion of both study and control group (36.7% and 33.3% respectively) were read and write only.**Concerned to diagnosis**, less than one third (30.0%) of study group had epidural hematoma compared to (20%) of control group and there was no significant difference among studied and control group regarding to age, sex, marital status, educational level andoccupation.

Table 1: concluded that the mean score of eye response on the 1st day pre application of program was same (2.03±0.18) for both group. Also there was improvement of mean score of study group 2.77±0.68, 3.23±0.43 and 4.00±0.00 compared to 2.07±0.37, 3.03±0.183 and 3.43±0.679 of control group on 1st, 2st week and one month later respectively.
In relation to verbal response; it was observed thatthemean score of verbal response on the 1st day pre application of program was similar 3.00±0.00for both groups**.** Post application of the programat 1st, 2nd week and one month later ,it was observed that significantly improvement of mean score of study group 3.43±0.50, 4.03±0.49 and 4.13±0.86 than control group 3.00±0.00, 3.03±0.183 and3.07±0.254 respectively**.**
In relation to motor response; the results indicated that themean score of motor response on the 1st day of both study and control groups was relatively equal (4.20±0.41 and 4.17±0.38) respectively and remained without change at1stweek, but at 2nd week and one month later, it was increased to 4.37±0.49, 5.17±0.379 versus (4.17±0.379, 5.10±0.55) for study and control group respectively**.**

Table 2: It can be seen that a significant improvement of total mean score of GCS (9.33±0.48, 10.40±1.04, 12.03±1.13 and 12.47±1.25) of study group compared to 9.20±0.407, 9.23±0.504, 9.27±0.640 and 11.27±0.521 of control group on the 1st day, 1st, 2nd week and one month later respectively. This table also showed a highly significant differences among study and control groups regarding total Glasgow Coma score on 1stday versus 1st week, 1st versus 2nd week, and 1st day versus one month later as a result of program application where P=0.00,while in control group the significant difference was observed only in the first day versus one month later.

Table 3: At the 1st day pre application of sensory and motor stimulation program it was noticed that all mean score of visual, auditory, tactile, olfactory, gustatory, motor, communication and arousal **response**, were equal for both groups (2.00±0.00), while on 1st, 2nd week and one month later; for **visual mean score** it was increased significantly in study group to (2.83±0.379, 3.73±0.521 and 3.97±0.718), compared to control group (2.37±0.49, 2.57±0.626 and 3.43±0.679) respectively.

Moreover, **auditory mean score** for study group after application of program was increased to 2.83±0.379, 3.73±0.521 and 3.79±0.521 compared to 2.37±0.49, 2.43±0.679 and 2.57±0.626 of control group on 1st, 2nd week and one month later respectively. Additionally, the **mean score of tactile response** of study group was 3.73±0.521, 3.73±0.521 and 3.80±0.610 on 1st, 2nd week and one month later respectively while the mean score of the control group was increased gradually on the 1stweek (2.37±0.49) and then became almost equal on the 2nd week and one month later (2.57±0.626). **The olfactory mean score** of study group was increased to 2.83±0.379, 3.97±0.718 and 3.97±0.718 compared to1.00±0.00, 1.23±0.568 and1.43±0.679 for control group on 1st, 2nd week and one month later respectively.

Furthermore, mean score of **gustatory**scores for study group was increased to 2.83±0.379, 3.93±0.718 and 3.97±0.718 comparedto (2.23±0.56, 2.37±0.49 and 2.43±0.679) of control group on 1st, 2nd week and one month later respectively. Likewise, motor function score was 2.83±0.379, 3.97±0.718 and 3.97±0.718 versus 2.00±0.00, 2.23±0.568 and 2.43±0.679 of study and control group on the 1st, 2nd week and one month later respectively.

Table 4: shows that highly statistically significant difference in the study group regarding total (SMART) score on 1st,day versus 1st,week, 1st,week versus 2nd week and 1st,day versus one month later , where P= 0.00 each. Moreover, for control group it was statistically significant difference only at the 1st, day versus 1st, week and one month later, where p=0.001, 0.00 respectively.

Figure 1: shows total mean scores of Sensory Modality Assessment and Rehabilitation Technique (SMART) of patients with moderate head injury of both studied groups pre and post application of sensory and motor stimulation program. It can be noticed that, the mean score of total (SMART) was 16.00±0.00, 22.67±3.032, 31.03±4.832, 31.37±4.45 of study group which increased significantly post application of sensory and motor stimulation programcompared to control group 15.00±0.00, 16.47±1.961, 18.20±5.020, 20.47±5.431at 1st day, 1st, 2nd week and one month later respectively.
Table 5: It was observed from the table that the total mean score of Chelsea Critical Care Physical Assessment on 1st day was (2.77±.000) for study and control groups, which increased significantly to 13.30±1.343,

20.57±1.736 and 22.77±1.995 for study group compared to 12.17±1.895, 15.60±3.255 and 19.00±2.877 at 1st, 2nd week and one month later respectively.

The difference was highly statistical significant in study group in comparison to control group at 1st , 2nd week and 1 month later as a result of program application in which P= 0.00 each.

Table 6: revealed that; the mean score of Rancho Los Amigos was the same (2.00±0.00) on 1st day of study and control groups which increased at 1st, 2nd week and one month later to 2.83±0.379, 3.73±0.521 and 3.97±0.718 respectively for study group compared to control group 2.37±0.49, 2.57±0.626 and 3.43±0.679 respectively, with a statistical significant between study and control group since p=0.00, 0.00 and 0.005 respectively. It is also illustrated from that table that there was a highly statistical significant differences in mean score of Rancho Los Amigos for study group on 1st versus 2nd week and 1st day versus one month later as a result of program application in which P= 0.00 each. Additionally, the statistically significant difference for control group was found only at 1st day versus one month later where P= 0.008.

Table 7: It can be noticed that there was no significant correlations between total GCS and total Rancho Los Amigo score in control group, where p>0.05 during study period .On the other hand, for study group, it was found that a positive significant correlation between total Rancho Los Amigo scores in the 2nd week and total GCS scores in the 2nd week and one month later where p= 0.022 and 0.024 respectively. Moreover, there was a positive significant correlation between total Rancho Los Amigo scores and total GCS scores at one month later and total GCS scores in 2nd week and one month later where p= 0.022 and 0.024 each.

Table 8: Presents that about two third (60.0%)of study group had shorter duration of stay in ICU (15-20) days, compared to (33.3%) of control group. Moreover, approximately equal percent (33.3% and 30%) of study and control group respectively, had same duration of stay (21-26) days. Conversely highest proportion 36.7% of control group had longer duration of stay in intensive care unit more than 27 days compared to lowest proportion 6.7% of study group. It is also observed that there was a significant difference between both study and control group in relation to duration of stay in I C U since P = .014.

Table (1): mean scores and stander deviation of Glasgow Coma Scale (GCS) domains of patients with moderate head injury of both studied groups pre and post application of sensory and motor stimulation program

Glasgow Coma Scale (GCS) domains		Patients with moderate head injury of both studied groups			
		Study group (n=30)	Control group (n=30)	F	P
		Mean±SD	Mean±SD		
1. Eyes open	1st day	2.03±0.18	2.03±0.18	-	-
	1st week	2.77±0.68	2.07±0.37	24.74	0.00*
	2nd week	3.23±0.43	3.03±0.183	5.495	0.023*
	One month later	4.00±0.00	3.43±0.679	20.900	0.00*
2. Verbal response	1st day	3.00±0.00	3.00±0.00	-	-
	1st week	3.43±0.50	3.00±0.00	22.18	0.00*
	2nd week	4.03±0.49	3.03±0.183	109.67	0.00*
	One month later	4.13±0.86	3.07±0.254	42.423	0.00*
3. Motor response	1st day	4.20±0.41	4.17±0.38	0.108	0.744
	1st week	4.20±0.41	4.17±0.38	0.108	0.744
	2nd week	4.37±0.49	4.17±0.379	3.126	0.08
	One month later	5.17±0.379	5.10±0.55	0.301	0.586

Z- Value of Wilcoxon's paired test.

* Significant at level P< 0.05

Table (2): comparison of total mean scores of Glasgow Coma Scale (GCS) of patients with moderate head injury of both studied groups pre and post application of sensory and motor stimulation program

Total GCS	Patients with moderate head injury of both studied groups			
	Study group (n=30)	control group (n=30)	F	P
	Mean±SD	Mean±SD		
1st day	9.33±0.48	9.20±0.407	1.349	0.25
1st week	10.40±1.04	9.23±0.504	30.70	0.00*
2nd week	12.03±1.13	9.27±0.640	136.37	0.00*
One month later	12.47±1.25	11.27±0.521	23.49	0.00*

Z P	1st day versus 1st week	4.235 0.00*	1.00 0.317		
	1st week versus 2nd week	4.620 0.00*	1.00 0.317		
	1st day versus 1 month later	4.856 0.00*	5.324 0.00*		

* Significant at level P< 0.05

Table (3) Mean score of SMART domain pre and post application of sensory stimulation

SMART domains		Control group (n=30)	Study group (n=30)	F	P
		Mean±SD	Mean±SD		
1. Visual	1st day	2.00±0.00	2.00±0.00	-	-
	1st week	2.83±0.379	2.37±0.49	17.018	0.00*
	2nd week	3.73±0.521	2.57±0.626	61.568	0.00*
	One month later	3.97±0.718	3.43±0.679	8.734	0.005*
2. Auditory	1st day	2.00±0.00	2.00±0.00	-	-
	1st week	2.83±0.379	2.37±0.49	17.018	0.00*
	2nd week	3.73±0.521	2.43±0.679	61.568	0.00*
	One month later	3.79±0.521	2.57±0.626	69.245	0.00*
3. Tactile	1st day	2.00±0.00	2.00±0.00	-	-
	1st week	3.73±0.521	2.37±0.49	17.018	0.00*
	2nd week	3.73±0.521	2.57±0.626	61.568	0.00*
	One month later	3.80±0.610	2.57±0.679	67.240	0.00*
4. Olfactory	1st day	2.00±0.00	2.00±0.00	-	-
	1st week	2.83±0.379	1.00±0.00	701.80	0.00*
	2nd week	3.97±0.718	1.23±0.568	267.12	0.00*
	One month later	3.97±0.718	1.43±0.679	197.06	0.00*
Gustatory	1st day	2.00±0.00	2.00±0.00	-	-
	1st week	2.83±0.379	2.23±0.56	17.018	0.00*
	2nd week	0.718±3.93	2.37±0.49	107.42	0.00*
	One month later	3.97±0.718	2.43±0.679	72.193	0.00*
Motor Function	1st day	2.00±0.00	2.00±0.00	-	-
	1st week	2.83±0.379	2.00±0.000	145.00	0.00*
	2nd week	3.97±0.718	2.23±0.568	107.42	0.00*
	One month later	3.97±0.718	2.43±0.679	72.193	0.00*
Communication	1st day	2.00±0.00	2.00±0.00	-	-
	1st week	2.83±0.379	2.00±0.000	145.00	0.00*
	2nd week	3.97±0.718	2.40±0.932	53.163	0.00*
	One month later	3.97±0.718	2.43±0.679	8.734	0.005*
Arousal	1st day	2.00±0.00	2.00±0.00	-	-
	1st week	2.83±0.379	2.00±0.000	145.00	0.00*
	2nd week	3.97±0.718	2.40±0.932	53.163	0.00*
	One month later	3.97±0.718	2.43±0.679	72.193	0.00*

Table (4): Comparison of total mean scores of Sensory Modality Assessment and Rehabilitation Technique (SMART) of patients with moderate head injury of both studied groups pre and post application of sensory and motor stimulation program

Total SMART		Patients with moderate head injury of both studied groups			
		Study group (n=30)	control group (n=30)	F	P
		Mean±SD	Mean±SD		
1st day		16.00±0.00	15.00±0.00	-	-
1st week		22.67±3.032	16.47±1.961	88.442	0.00*
2nd week		31.03±4.832	18.20±5.020	101.78	0.00*
one month later		31.37±4.453	20.47±5.431	72.261	0.00*
Z	1st day versus 1st week	5.00	3.317		
P		0.00*	0.001*		
	1st week versus 2nd week	4.876	0.294		
		0.00*	0.769		
	1st day versus One month later	5.031	4.968		
		0.00*	0.00*		

Z- Value of Wilcoxon Signed Ranks Test.
* Significant at level P< 0.0

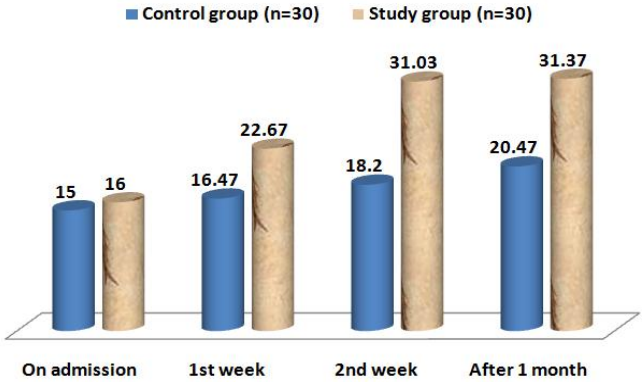

Figure (1): Total mean scores of Sensory Modality Assessment and Rehabilitation Technique (SMART) of patients with moderate head injury of both studied groups pre and post application of sensory and motor stimulation program

Table (5): Comparison of total mean scores and stander deviation of Chelsea Critical Care Physical Assessment of patients with moderate head injury of both studied groups pre and post application of sensory and motor stimulation program

Total Chelsea Critical Care Physical Assessment		Patients with moderate head injury of both studied groups			
		Study group (n=30)	Control group (n=30)	F	P
		Mean±SD	Mean±SD		
1st day		2.77±.000	2.77±.000	-	-
1st week		13.30±1.343	12.17±1.895	7.142	0.00*
2nd week		20.57±1.736	15.60±3.255	54.391	0.00*
1 month later		22.77±1.995	19.00±2.877	34.734	0.00*
Z	1st day versus 1st week	4.814	5.152		
P		0.00*	0.00*		
	1st week versus 2nd week	4.825	4.941		
		0.00*	0.00*		
	1st day versus One month later	4.824	4.983		
		0.00*	0.00*		

Table (6): Comparison of mean score of Rancho Los Amigos of patients with moderate head injury of both studied groups pre and post application of sensory and motor stimulation program

Rancho Los Amigos		Patients with moderate head injury of both studied groups			
		Study group (n=30)	Control group (n=30)	F	P
		Mean±SD	Mean±SD		
1st day		2.00±0.00	2.00±0.00	-	-
1st week		2.83±0.379	2.37±0.49	17.018	0.00*
2nd week		3.73±0.521	2.57±0.626	61.568	0.00*
one month later		3.97±0.718	3.43±0.679	8.734	0.005*
Z P	1st week versus 2nd week	4.660 0.00*	1.633 0.102		
	1st day versus one month later	4.874 0.00*	2.656 0.008*		

Table (7): Correlation between total Glasgow Coma Scale and Rancho Los Amigo score of patients with moderate head injury of both studied groups throughout the study period

Total Rancho Los Amigo score	Total Glasgow Coma score					
	Control group			Study group		
	1st week	2nd week	One month later	1st week	2nd week	One month later
	R P	R P	R P	R P	R P	R P
1st week	0.326 0.079	0.326 0.079	0.285 0.127	0.347 0.060	0.269 0.151	0.248 0.186
2nd week	0.101 0.595	0.101 0.595	0.058 0.760	0.106 0.578	0.418 0.022*	0.410 0.024*
One month later	0.056 0.769	0.056 0.769	0.107 0.573	0.106 0.578	0.418 0.022*	0.410 0.024*

Table (8): Percentage distribution of the patients with moderate head injury of both studied groups according to their duration of stay in intensive care unit post application of sensory and motor stimulation program

Duration of stay in ICU	Patients with moderate head injury of both studied groups						χ^2 P
	Study group (n=30)		Control group (n=30)		Total (n=60)		
	N	%	N	%	N	%	
15- 20 days	18	6o	10	33.3	28	46.7	8.56
21-26 days	10	33.3	9	30	19	31.7	.014*
>27 days	2	6.7	11	36.7	13	21.6	

Significant at level P< 0.05

V. Discussion

Characteristics of the study sample;the present study illustrated that the mean age among study and control subjects was 28.08±10.17 years and more than one third of both groups were in age group of 21 to 30 years. It is justified by the fact that younger adult group are usually considered at high risk group because they had rapid lifestyle with lack of safety precaution application. This finding was congruent withAmir et al (2015) (23), who mentioned thatmore than half of study subjects with head injury were in the age group of 20 years or more years old andare most likely to sustain a traumatic brain injury. Similarly Eldaodae (2015) (24), reported that the majority of age among studied groups was ranged from 20 to 40 years. On the other hand Langlois et al (2006) (25) and McKinlay et al (2008) (26), mentioned that the children and young adolescent are high risk group of head injury.

Regarding sex, the present study showed that the majority of the patients in both groups were male where males generally have special work circumstances such as; industrial, manual works, carried out strenuous and hazardous activity. This finding was in accordance with Hassan et al (2010) (27), who stated that males were at higher risk for head injury than females. In addition,Ghoniem(2011)(28), stated that the majority of studies groups with head injury were male. Nevertheless, this result contradicted with El sawaf(1995) (29), reported that females had a higher percentage of head injury occurrence than male Regarding level of education the current study showed that the highest percentage of both groups were read and write, while minority of both groups were illiterate. This result was in line with Amir et al(2015) (23), who stated that more than half of the patients were able to read and write only.

Regarding to occupation, the present finding showed that most of control and study groups had manual work. This result was congruent with Amir et al (2015) (23), who mentioned that more than one quarter of

studied groups with head injury were farmers and nearly one fifth of them were housewives. Additionally, Eldaodae (2015) (24), found that the most common work among head injured patients was the manual work.

In relation to diagnosis, it is obvious from the current study that more than one third of control group had cerebral contusion, followed by subarachnoid hemorrhage. However, nearly one third of study group had epidural hematoma, followed by cerebral contusion. This result was in line with Eldaodae (2015) (24) andElbansway (2013) (30), who reported that the most of head injury patient had cerebral contusion and subarachnoid hemorrhage.

Effects of sensory and motor stimulation program on the level of consciousness as presented by Glasgow Coma Scale (GCS).

The present finding showed that the mean score of GCS score increased significantly in study group than control group after application of sensory and motor stimulation program on first, second week and one month later which may be explained by that the improvement result from application of sensory and motor stimulation that arouse the brain by improving neuronal organization, increased numbers of dendrite spines, thus stimulating the reticular activating system and increasing the level of sensory function(11,12).

This result was in line with Karma andRawat)2006)(31),who concluded that the means scores of GCS's at the 14th day after application of stimulation program was significantly improved for study group than control group. Additionally ,Pornnipa,et al)2009)(32), noted that the application of sensory stimulation on traumatic brain injury patients for two weeks improve the conscious level more significantly in study group than the control group . Likewise, Megha et al (2013)(33), reported that the patients with head injury had a higher significant mean score of GCS scores post application of multimodal stimulation after 2 weeks.

Effect of sensory and motor stimulation program on cognitive function among patients with moderate head injury.

Results of current study presented that the study group began responding to stimulation program in a reflexive way and progressed towards more purposive responses than control group, additionally the mean score of cognitivefunction increased more significantly in study group after application of sensory and motor stimulation program for moderate head injured patients than control group during the period of study.This finding was in congruent withKalani et al (2016) (34), they showed that the guidedregular family visit improved the level of cognitive function of patients with head injury. Likewise, Pornnipa,et al)2009) (32),stated that the application of stimulation program can stimulate of reticular activation system so improve brain recovery and enhance the cognitive function of head injury patients. .Moreover Mohammad (2004)(35)and Davis and Gimenez(2003) (36),mentioned that the study group with head injury had a greater improvement in level of cognitive function scores between baseline and at discharge periods. Additionally;Kater (1989)(37), clarified that application of organized sensory stimulation improve cognitive function significantly of study group with head injury than control group.

On the other hand;Lombardi et al (2002) (38), and Johnson et al (1993)(39), reported that the patients with head injury didn't have any improvement of cognitive function after application of sensory stimulation. Additionally, the result of the current study indicated that the mean score of Ranch Los Amigo Score was significantly increased for control group after one month.This result in line with El-siad (2011) (40) andMohamad (2004) (35), found that the routine nursing activities for different senses stimulate the sensory pathway and activate reticular activation system which lead to improve the patients perception and memories process. Conversely Karma andRawat (2006) (31), and Davisand Gimenez (2003) (36), noticed that the cognitive function of control group didn't improved after application of stimulation program.

The effect of sensory and motor stimulation program on sensory functions evaluated by SMART scale among patients with moderate head injury.

The current study showed that the total mean score of Sensory Modality Assessment and Rehabilitation Techniqueof study group was increased more significantly after application of sensory and motor stimulation program throughout periods of study. It can be justified by; the stimulation program promotes brain organization by stimulating the reticular activating system through the sensory information received from 5 senses. Other indices, describe the stimulation program improve secretion of neurotransmitters as 3methoxy; 4hydroxyphenylglycol levels which promotes brain recovery (11)

This result was supported withPornnipaet al (2009) (32), who concluded that the mean average scores of SMART for all sensory modalities in study group with head injury were significantly higher after application of stimulation program, alsoMoattari et al (2016)(41)andMandeep et al (2012) (42), noticed that the head injured patients who exposed to stimulation program provided by the family and nurse had a significant recovery of sensory function compared to control group. Moreover Oh and Seo (2003)(43), showed that an improvement scores of the tactile and auditory modalities after application of stimulation program for patients with head injury after 2weeks. In addition Lippert et al (2002) (44), and Davis and Gimenez (2003)(36)found that; the unconscious patients with head injury were started to have tactile and auditory responses on days 5-6 and noticed that the visual responses were begun after 10-12 days and Lippert and Terhaag (2000) (45), concluded

that the most significant changes were caused by tactile and acoustic stimulation resulted mainly in head and eye movements.

Nevertheless, this result was contradicted with the result of Lombardi et al (2002) (38), andJohnson et al (1993) (39) who reported that the application of sensory stimulation on adult patient with traumatic brain injury didn't improve of sensory function.

The effect of sensory and motor stimulation program on physical function of patients with moderate head injury

It was obvious from the present study that the total mean scores of Chelsea Critical Care Physical Assessment among study group was increased significantly for the most items after application of sensory and motor stimulation program after one month, except of the standing balance and stepping movement. It can be clarified by the moderate head injured patients with GCS 9-12 have better improvement of physical function more than the patients with lower score. Moreover, the improvement of these items of the scale considered as a simple activity performed with assistance or alone as grip strength.

This finding was supported with Haalandet al (1994) (46) who reported that the grip strength of head injured patients is more sensitive to recovery after head injury. Similarly,Bowen et al (2008) (47),stated that non-pharmacological intervention for sensory dysfunction due to an acquired brain injury, could improve physical function, also Hellweg (2012) (48), concluded that early intensive rehabilitation significantly improves the functional outcome of the first months following the accident. The result was in contrast with Hashmi (2015) (49), who found that; no significant increase of mean score of total Chelsea critical care physical assessment after application of rehabilitation program at intensive care unit . Additionally Lombardi et al (2002) (38), and Johnson et al (1993) (39), recorded that the application of sensory stimulation on adult patient with traumatic brain injurydidn't improvephysical function.

In relation to length of stay in intensive care unit, it was found that the study group had shorter length of stay in ICU compared to control group with a significant difference among both groups. This may be due to an improvement of cognitive function and conscious level that reflected on patient general function outcomes. This finding was in line with El-siad (2011) (40), Pornnipa,et al (2009) (32), and Mohamed (2004) (35), who stated that the study group who participate in stimulation program had a short length of stay in intensive care unit. Also, Kater(1989) (37), found that patients in the study group who engaged in sensory stimuli had short hospitalization period.

Correlation between Glasgow coma scale (GCS)and Rancho Los Amigo Score level of cognitive function scale scores.

The finding of the current study revealed that a significant positive correlation between total GCS and LCFS score among study group at first, second week and one month after application of stimulation program.Similarly, Zafonte et al (1996) (50), found positive relationship between the GCS scores and a Rancho Los Amigos Levels of Cognitive Function Scale. This result was contradicted with Novack et al (2001) (51), who noticed that no significant relationship was found between GCS and cognitive outcomes for head injury patients.

VI. Conclusion

The result of the present study supported the application of sensory and motor stimulation program for moderate head injury patients after hemodynamic stability. Furthermore, the sensory and motor stimulation program may produce a positive improvement on the level of consciousness, cognitive and sensory function of moderate brain-injured patients.

VII. Recommendation

Based on the finding of the current study the following recommendation are derived and suggested:
For patients:Sensory and motor stimulation program can play an important role to improve conscious level for traumatic head injury patients with combination of pharmacological intervention. Family members should be involved of sensory and motor stimulation to promote recovery and provide inner peace for the traumatic head injury patients. For nurses:Critical care nurses should implement sensory and motor stimulation for moderate head injury patients as a daily routine of patients care and development of in-service education program for all nurses working in critical care unit about different types of the sensory and motor stimulation for traumatic head injury patients

References

[1]. Popescu C1, Anghelescu A1, Daia C1 and Onose G1. Actual data on epidemiological evolution and prevention endeavours regarding traumatic brain injury Med Life J. 2015;8(3):272-7.
[2]. Andelic N. The epidemiology of traumatic brain injury. The Lancet Neurology. 2013; 12(1):28–9.
[3]. World Health Organization. Violence and injury prevention and disability (VIP) 2011.Available at: www.who.int/violence injury prevention injury/ burns. Retrieved on 4/10/2015.

[4]. Statistical Records in Tanta University Hospital 2015.
[5]. Silver J.M., McAllister, T.W., and Yudofsky SC. Textbook of Traumatic Brain Injury, 2nd ed., Washington, DC: American Psychiatric Publishing Inc, 2011; 412-13.
[6]. Zasler N, Katz D, Zafonte R. Brain Injury Medicine: Principles and Practice.NewYork, Demos .Com; 2007; 937-38.
[7]. Mclean M, Ruff S, Graber p and Bucher L .Medical Surgical Nursing: Assessment and Management of Clinical Problems. 8thed. Philadelphia: Mosby & Elsevier; 2011; 483,507.
[8]. Greenwald, B.D, and Rigg J. Neuro rehabilitation in traumatic brain injury: Does it make a difference? Mount Sinai Journal of Medicine, 2009, 76(2): 182–89.
[9]. American Medical Empire Blue Cross and Blue Shield Association. Sensory stimulation for coma patients, June 2009.Avialable at https://www.empireblue.com/medicalpolicies/policies/mp.
[10]. Tolle P and Reimer M. Do we need stimulation programs as a part of nursing care for patients in "persistent vegetative state?" A conceptual analysis.. 2003; 25(2): 20-6.
[11]. Baker J. Coma Arousal Theory and Practical Considerations. [Online]. 2010 Available at: http://www.comacare.com/cgi bin/giga.cgi?cmd=cause_dir_news_item&cause_id=1784&news_id=84750&cat_id=0. Retrieved on Oct 31, 2012.
[12]. Bach Y, Rita P. Theoretical basis for brain plasticity after a traumatic brain injury. Brain Injury J.2003; 17(8):643-51.
[13]. Poser JB, Plum and Posner's Diagnosis of Stupor and Coma 4th ed, OxfordUniversity Press, 2007.
[14]. Barbarito D. Health and Physical Assessment in Nursing, London, Pearson Co, 2007; 123-133.
[15]. Teasdale G and JennettB.Assessment of coma and impaired consciousness: A practical scale. Lancet, 1974; 2 (72): 81- 4.
[16]. McNett M1. A review of the predictive ability of Glasgow Coma Scale scores in head-injured patients. J NeurosciNurs. 2007; 39(2):68-75.
[17]. Gill H and Mundy, R. The Sensory Modality Assessment and Rehabilitation Technique
[18]. (SMART): A comprehensive and integrated assessment and treatment protocol for the vegetative state and minimally responsive patient. Neuropsychological Rehabilitation, 1999 ;(9); 305-20.
[19]. Corner EJ, Wood H and Englebretsen C.: The Chelsea Critical Care Physical Assessment Tool: validation of an innovative new tool to measure physical morbidity in the general adult critical care population; an observational proof-of-concept pilot study. Physiotherapy J, 2012; 99 (1):33-7.
[20]. Christakou A, Papadopoulos E, Patsaki I and Sidiras G. Functional Assessment Scales in a General Intensive Care Unit. A review, hospital chronicles 2013; 8(4): 164–70.
[21]. Hagen C, Malkmus D and Durham P. Communication Disorders Service, Rancho Los Amigos Hospital, 1972. Rancho Los Amigos National Rehabilitation center Available at. http://www.rancho.org/Research_RanchoLevels.aspx Retrieved on May 15, 2011.
[22]. Dawson B and Trapp R G. Basic and Clinical Biostatistics. Lange Medical Book/ McGraw-Hill, Medical Publishing Division. 3rd ed, USA.2001. 161,218.
[23]. Petrie A and Sabin C. Medical Statistics at a Glance. 2nd ed., Blackwell Publishing, 2005.
[24]. Amir M, Alotaibi A, Albaradie R and Elrazkey G. Effect of supine versus semi-fowler's positions on hemodynamic stability of patients with head injury. World journal of Pharmaceutical research, 2015; l4 (4): 1559-69.
[25]. Eldoadae W. Study of Epidemiological Pattern of Head Injury Due to Road Traffic Accident in KafrSaadCeteralDamiette Governorate. Unpublished Master Thesis. Faculty of Medicine. Tanta University. 2015.
[26]. Langlois JA, Rutland W and Thomas KE. Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations, and Deaths. Atlanta, GA: Centers for Disease Control and Prevention National Center for Injury Prevention and Control; 2006.
[27]. McKinlay A, Grace C, Horwood L and Fergusson M. Prevalence of traumatic brain injury among children, adolescents and young adults: Prospective evidence from a birth cohort. Brain Injury J.2008; 22(5) 175-81.
[28]. Hassan N, El Kelany R, Emara A, Amer A. Pattern of craniofacial injuries in patients admitted to Tanta University Hospital Egypt. Forensic and legal medicine Journal 2010; 17(1):26-32.
[29]. GhoneimN. Impact of implementing nursing care protocol on moderate head injured patient's outcomes .Doctoral Dissertation. Faculty of Nursing; Tanta University.2012.
[30]. El-Sawaf. Management of traumatic intracranial hemorrhage. Unpublished Master Thesis. Faculty of Medicine. Tanta University.1995.
[31]. Elbhansawy M .The Prognostic factors affecting outcomes of acute traumatic subdural heamatoma. Unpublished Master Thesis. Faculty of Medicine. Tanta University.2013.
[32]. Karma D and Rawat AK. Effect of stimulation in coma. Indian Pediatr J. 2006; 43(10): 856-60.
[33]. Pornnipa U, Chanokporn J and Surachai K. Effects of the sensory stimulation program on recovery in unconscious patients with traumatic brain injury. Journal of Neuroscience Nursing 2009; 41 (3):501-9.
[34]. Megha M, Harpreet S and Nayeem Z. Effect of frequency of multimodal coma stimulation on the consciousness levels of traumatic brain injury comatose patients. Brain Inj. 2013; 27:570–7.
[35]. Kalani Z, Pourkermanian P and Alimohammadi N,The Effect of Family Guided Visits on the Level of Consciousness in Traumatic Brain Injury .Biology and today world J. 2016;5 (5) 86-90.
[36]. Mohamed Z. Impact of Sensory Stimulations Provided to Head Injured Patients Upon Their Cognitive Response In Shebin El-Kom University Hospital. Unpublished Doctorate Dissertation. Faculty of Nursing. University of Menofia, 2004
[37]. Davis AE and Gimenez A. Cognitive-behavioral recovery in comatose patients following auditory sensory stimulation. J Neurosci Nurs. 2003; 35(4):202-9.
[38]. Kater, K M. Response of head-injured patients to sensory stimulation. Western Journal of Nursing Research, 1989; 11(1), 20-33.
[39]. Lombardi F, Taricco M, Tanti A, Telaro E and Liberati A. Sensory stimulation of brain-injured individuals in coma or vegetative state: results of a Cochrane systematic review. Clin Rehabil. 2002; 16:464-72.
[40]. Johnson DA, Johnston R K and Richards D. Biochemical and physiological parameters of recovery in acute severe head injury: responses to multisensory stimulation .Brain injury J 1993; 7:491-9.
[41]. El-said M. The effect of implementing a structured stimulation program on altered consciousness of critically ill patients at Mansoura University. Unpublished Doctorate Dissertation. Faculty of Nursing. University of Mansoura, 2011.
[42]. Moattari M, Shirazi F, Sharifi N and Zareh N. Effects of a Sensory Stimulation by Nurses and Families on Level of Cognitive Function, and Basic Cognitive Sensory Recovery of Comatose Patients With Severe Traumatic Brain Injury: A Randomized Control Trial. Trauma Monthly J.2016; 21(1):2-10.
[43]. Mandeep K, Chitkara N, Goel S and Sood S .Traumatic head injury: Early intervention by coma arousal therapy. The Indian Journal of Neurotrauma; 2013; 10(1):13-8.

[44]. Oh H and Seo W. Sensory stimulation programme to improve recovery in comatose patients. Journal of Clinical Nursing, 2003.12 ;(3) 394-4.
[45]. Lippert M, Wedekind C, Ernestus I and Klug N: Early rehabilitative concepts in therapy of the comatose brain injured patients. Acta Neurochir 2002; 79:21-3.
[46]. Lippert M and Terhaag D: Multimodal early onset stimulation (MEOS) in rehabilitation after brain injury. Brain Injury J.2000; 14 (6): 585-94.
[47]. Haaland KY, Temkin N, Randahl G and Dikmen S. Recovery of simple motor skills after head injury. J Clin Exp Neuropsychol. 1994; 16(3):448-56.
[48]. Bowen A, Knapp P, Gillespie D and Vail A. Non-pharmacological interventions for perceptual disorders following stroke and other adult, acquired, non-progressive brain injury. Cochrane Database of Systematic Reviews.2011;43(4):5-50.
[49]. Hellweg S.Effectiveness of physiotherapy and occupational therapy after traumatic Brain Injury in the Intensive Care Unit. Critical Care Research and Practice, 2012, 768456-61.
[50]. Hashmi M .Evaluating impact of the Chelsea critical care physical assessment (CPAx) tool on rehabilitation in critical care and feasibility in practice. J Rehabil Med 2012; 44: 505–11.
[51]. Zafonte, R. D., Hammond, F. M., Mann, N. R., Wood, D. L,Relationship between Glasgow Coma Scale and functional outcome. American Journal of Physical Medicine & Rehabilitation, 1996; 75(5), 364–69.
[52]. Novack TA, Bush B A, Meythaler JM and Canupp K. Outcome after traumatic brain injury: Pathway analysis of contributions from premorbid, injury severity, and recovery variables. Archives of Physical Medicine and Rehabilitation, 2001; 82(3), 300-5.a narrative review. Journal of Physiotherapy. 2015; 98 (12): 1–12.