

## Original Article

# ANALYZING EFFECT OF CONTOURED FOAM SEAT ON MULTIDIRECTIONAL REACHING ABILITY IN ACUTE STROKE SUBJECTS

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## ABSTRACT

**Background & Objective:** Cerebrovascular accident is the major disease that leads to an increase in the number of people with motor or sensory impairment or loss of function on one side of the body (hemiplegia). Poor sitting ability is a common problem after stroke. Sitting involves not only the ability to maintain the seated posture, but also the ability to reach for a variety of objects located both within and beyond arm's length. Contoured foam seat (CFS) have shown improvement in sitting posture, head control and upper extremity function in pediatric age group suffering from cerebral palsy in previous studies. So this study was designed to evaluate the effectiveness of contoured foam seat on sitting posture and multidirectional reaching ability in acute stroke subjects. **Methodology:** The study design of this pilot study is having ten Acute stroke subjects as sample. After taking the informed consent, subjects were made to sit on a chair and multidirectional reaching ability distance was measured with and without contoured foam seat. Multidirectional reaching distance was assessed with CFS and without CFS and obtained data was analyzed. Data was collected by measuring the maximum reaching ability distance. **Result:** Reaching ability in sitting position significantly improved after application of CFS. Unaffected side reaching was significantly improved as compare to forward and affected side reach after application of CFS. **Discussion & Conclusion:** Contoured foam seat can significantly improve pelvic alignment and provide a good postural stability thereby improve sitting posture and functional reaching ability in acute stroke subjects.

**KEYWORDS:** Acute Stroke; Reaching Ability; Contoured foam seat.

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## INTRODUCTION

Stroke is the leading cause of long term disability among adults. Longitudinal studies of recovery after stroke suggest that only 50% of patient with significant arm paresis recover useful function. Hemiplegic with poor sitting ability is a common problem after stroke. <sup>1,2</sup>

A prospective study demonstrated that 48% and 27% of stroke patient were unable to sit independently at the onset and the end of rehabilitation respectively. Functional ability to maintain normal sitting posture is based on functional activity in a seated posture. Recovery of sitting after stroke is important for individual

because sitting is a skill that is critical to independent living. Sitting involves not only the ability to maintain the seated posture, but also the ability to reach for a variety of objects located both within and beyond arm's length. <sup>3</sup>

The disability in reaching tasks arises not only from the impairments caused by the neural lesion, such as weakness and loss of coordinated movement, but also from the tendency to adapt behavior to avoid the threat to balance. Sitting ability has been shown to be a useful prognostic indicator of outcome for this population. <sup>4</sup>

In particular, it has been shown that in comparison to healthy individuals, individuals

after stroke are slower and do not load their affected foot or activate muscles of the affected leg sufficiently when reaching beyond arm's length in sitting (Dean and Shepherd 1997). In previous studies contoured foam seat (CFS) have been shown improvement in sitting posture, head control and upper extremity function in pediatric age group suffering from cerebral palsy.<sup>5</sup>

Contoured foam seat is a type of adaptive seat device currently used by therapist, which is intended to improve pelvic alignment, increase postural stability and somatosensory feedback for children with neuromotor impairment. Benefits of adaptive seating include improved postural alignment and facilitation of upper-extremity function.<sup>6</sup>

It is imperative that health professionals prescribing and engineers designing seating equipment are well informed regarding the fundamental seating principles that dictate the sitting postures of children and young people and the impact they have on long term health and function. So this research was design to confine whether CFS can enhance multidirectional reaching ability in acute stroke subject.

## METHODOLOGY

The study design of this pilot study is having ten Acute stroke subjects as an sample at Himalayan hospital Dehradun-UK. Inclusion criteria: Both male and female, GCS should be 15, MMSE- more than 23, Subjects should be medically cleared by the physician for physiotherapy and mobilization, Age- 40 to 65, Able to sit independently for 10 second, Sitting balance score is 2 according to MAS ( motor assessment scale for stroke patients). Exclusion criteria: Visual and hearing impairments, Sensory aphasia, Ortho-pedic problems which would interfere with the ability to perform seated reaching tasks, pressure sore. Outcome measure- Maximum reaching distances in forward and sideway direction.

**Procedure:** 10 subjects were screened based on the inclusion and exclusion criteria. Consent was taken and the purpose and procedure of the study was explained to the patient and care takers.

**Preparation of the test room:** Test room which comprise of a chair with hand and back support, a vertical and movable mirror, movable and vertical upright pole. A point in the floor was marked beneath the chair by calculating the mid of the distance between the front two legs of the chair. From that midpoint 1 perpendicular and 2 line at 45° was drawn with the help of goniometer and marker. Then a cello tape is applied over the line drawn by the marker. Mirror was placed in front of the chair.

## Pre test reading- pre test reading was taken in the following manner:

Patient is shifted to testing room and made to sit on the chair. Patient was asked to maintain erect sitting posture without using back support distance between acromion process of shoulder and floor was measure with measuring tape, this distance was marked in the pole with green ribbon .And then ask to reach forward with non affected upper limb and 90° flexion of shoulder without losing balance. Vertical pole was made in contact with the middle finger of the patient. 3 trials were given and the best forward reach distance was measured. Then the patient was ask to reach at 45° side way toward left and right in same manner and the maximum reaching distance was measured after 3 trial.<sup>7</sup>

After collection of pretest reading half an hour break was given to the patient. Then contoured foam seat was placed on the chair. Patient made to sit on the contoured foam seat and ask to obtain forward and sideway reach without losing balance. Post test maximum reach was measured again.

## Instrumentation:





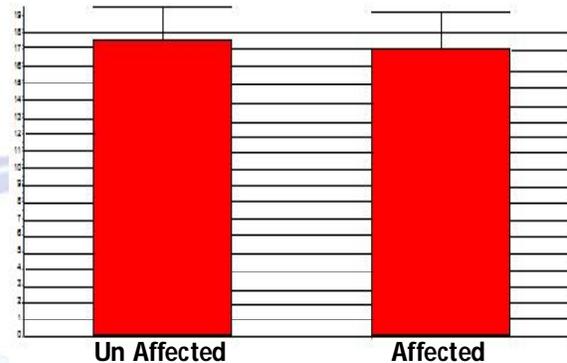
Contoured foam seat



Cello tape & chair

Without CFS	Mean± std. deviation	t-value	p-value
Unaffected	17.6±1.57	5.51	0.004
Affected	14.7± 2.26		
With CFS	Mean± std. deviation	t-value	p-value
Un Affected	20.0 ± 1.41	6.36	0.0001
Affected	17.5 ± 2.26		

**Table 3:** Comparison of mean, standard deviation, t value and p value between affected and unaffected side reaching ability.



**Graph 1:** Comparison of mean, standard deviation, t value and p value between Un affected and Affected side reaching ability with CFS.

## DATA ANALYSIS

Statics were performed by using Graph Pad software. Results were calculated by using Pd" 0.05 level of significance. Paired t-test was used to analyze and compared the score within the group.

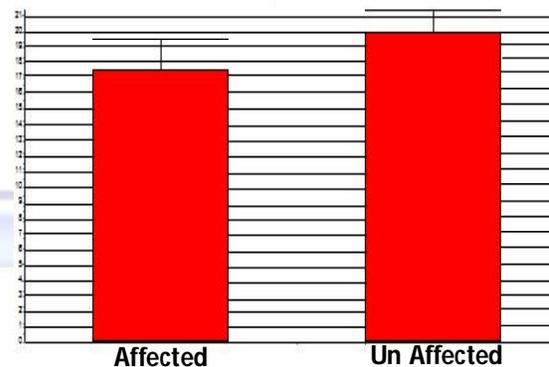
## RESULTS

Variable	Unaffected side Mean± std.	t-value	p-value
Without CFS	17.6 ± 1.57	10.8	0.001
With CFS	20.0 ± 1.41		
Variable	Affected side Mean ± std.	t-value	p-value
Without CFS	14.7± 2.26	5.12	0.006
With CFS	17.0± 2.26		

**Table 1:** Comparison of mean, standard deviation, t value and p value of reaching ability with CFS and without CFS.

Variable	Mean± std. deviation	t-value	p-value
Without CFS	15.8± 2.48	5.07	0.007
With CFS	17.5±2.06		

**Table 2:** Comparison of mean, standard deviation, t value and p value between forward reaching ability with and without CFS.



**Graph 2:** Comparison of mean, standard deviation, t value and p value between Affected and unaffected side reaching ability with CFS.

## DISCUSSION

The result obtained reveals that contoured foam seat in hemiplegic patient improved multidirectional reaching ability significantly proving the hypothesis of the study.

After application of CFS forward, unaffected and affected side reaching ability significantly improve. Seating literature suggested that the pelvis dictates the posture in the rest of the body and experimental studies suggested that pelvic position as a determinant of postural alignment for with neuromotor impairment.

CFS improves posture alignment and offer biomechanical advantage by keeping the pelvis

in neutral position and limits the degree of freedom. This neutral position of pelvis increases the postural stability through which patient can control the other segment of body and modify their reaching in all direction. CFS is more congruent as compare to normal seat and provides more body contact with the seating surface that facilitates more control and support to the subjects.<sup>7,8</sup>

Postural control also may have been assisted by nonslip foam surface of CFS. The vinyl surface of the chair allowed lateral or forward pelvic movement, leading to pelvic obliquity and asymmetrical weight bearing.

In hemiplegic patient there is a tendency of pelvis to retract and hip goes in external rotation through which foot goes in inversion and supination and at the end prevent weight bearing on affected foot. CFS there for prevent retraction and hip external rotation by the lateral support that increases weight bearing on affected foot. Massion J. et al suggested that foot pressure on the left side would be greater than the foot pressure on the right side of the healthy subject during the reaching task because there would be counterbalancing procedure in response to right reaching arm.<sup>9,10</sup>

Unaffected side reaching ability is significantly more than forward and affected side reach after application of CFS and Without CFS because hemiplegic patient used their unaffected foot for most of the weight bearing during reaching task and when there was movement toward unaffected side weight transfer increases in affected foot.<sup>11,12</sup>

Forward reach is more significantly improve than affected side reach without CFS but there was no significant improvement in forward reach and affected side reach after application proves that affected side reaching is also improve with CFS.

## CONCLUSION

Contoured foam seat effectively control sitting posture and thereby can significantly improve multidirectional reaching ability in acute stroke subjects.

## CLINICAL IMPLICATION

After stroke, regaining early sitting balance and control is prerequisite for the therapy and it is not possible to perform therapy for long hours in acute condition therefore CFS can be used to regain sitting balance and improve functional reaching ability and for Sit to stand that provides maximum weight bearing on affected lower limb

## LIMITATION OF THE STUDY

The small sample size was the major limitation of the study. CFS was not tailored as per the size of each subject. Standard size was taken for the study.

## FUTURE RESEARCH

Further studies can be done with larger sample size and on long term effect of CFS. CFS can be customizing as per the need of the patients. Future researches can be done on pusher's syndrome, cerebral palsy, sitting balance disorder like paraplegia quadriplegia.

## Conflict of Interest & ethical approval

There was no conflict of interest was reported among all authors. This research work is approved by ethical committee of HIPMS, HIHT University (UK) India.

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