

# THE DEVELOPMENT OF A NOVEL ADAPTIVE SEATING SYSTEM FOR CHILDREN WITH NEUROMUSCULAR DISORDERS

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## INTRODUCTION

Adaptive seating has been defined as *the customised prescription and application of sitting support devices based on therapeutic principles* [1]. It is recognised that for children with neuromuscular disorders resulting in poor postural control, a comfortable adaptive seating system that provides them with the support needed to maintain a sitting position can be essential for raising their overall level of well being [2]. These systems are also used to try and prevent or to slow the progression of skeletal deformities [3]. However, problems with current adaptive seating systems do exist [4] and the aim of this project was to identify these issues and design a novel system to address them.

## METHODS

In order to identify areas where improvements could be made to help seating systems in terms of their day-to-day use, a group of parents and teachers of children with neuromuscular disorders were interviewed and then asked to complete a formal questionnaire on their views on current adaptive seating systems.

Using the results from this survey, along with the existing literature on adaptive seating, a novel system was designed which incorporated features intended to tackle these problems and a fully functional prototype is being fabricated for testing.

## RESULTS AND DISCUSSION

From the questionnaire results it was found that both parents and teachers believed providing support, comfort, positioning for eating and preventing the occurrence of deformities to be the key functions of adaptive seating. Problem areas were identified as: the way seating systems cope with the often non-linear growth patterns of their users; systems breaking due to abnormal muscle tone; general reliability issues, i.e. brakes failing; and the time required for transferring children to and from their seating system.

The novel adaptive seating system shown in Figure 1 has been developed in response to these findings. It includes a number of innovative features including-

- *Active dynamic supports*: The backrest and headrest are mounted on gas springs, allowing them to move in order to accommodate the user's task induced movement or abnormal muscle tone. The forces applied to and the position of the supports are monitored and used to control motors attached to the gas springs. This means that the user can, when required, be returned to their original position in a controlled but still dynamic manner. The "floating" nature of these supports, especially the backrest, is also intended to allow for some growth of the user.

- *Novel backrest shape*: In an attempt to positively influence abnormal hip extensor tone, the user's trunk is given a predominantly lateral rather than posterior type of support. Preliminary results suggest that this approach could have some beneficial effects in terms of reducing abnormal hip extensor tone.
- *Multi-planar tilting seat base*: Tilting of the base in the sagittal and coronal planes can be actuated manually or pre-programmed to do so automatically at set intervals. This aims to improve user comfort and prevent the development of pressure sores and could also be used to accommodate deformities such as pelvic obliquities.



**Figure 1:** Computer model of adaptive seating system

All static supports have been designed to be highly adjustable to suit a wide range of users. The system can be simply and quickly changed between powered to manual modes by a single carer.

## CONCLUSION

Through these features the novel system has the potential to provide improved comfort, support and functionality for the users and to reduce the burden placed on those who care for them.

## REFERENCES

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