“ New Approach to Seating for Children with Severe Disabilities ”

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ABSTRACT

The Department of Rehabilitation Engineering, a section of Kitakyushu Sogo Ryoiku Center in Kitakyushu City, was established in 1979. This department has been designing and developing technical aids, especially seating devices and mobility aids, for children with physical disabilities.

For the past four years, we have been researching the active positioning for children and youth with Central Nervous System (CNS) disorders, aged 3 to 18 years old. This approach is based on the “Trunk Forward Inclining Position” (T.F.I.P., see Fig-1), which encourages the user not only to keep the back straight and upright position, but also move forward with greater dexterity. This improvement in mobility leads to a natural motivation to perform everyday mental task.

Many children and youth have been successfully provided with seating devices and mobility aids throughout our department. All of devices and aids have been custom designed for each disabilities.

INTRODUCTION

Traditionally, children with severe

involved disabilities have been provide with familiar chair and wheelchair which reclines deeply as if in a resting position. However, this position has a tendency to disturb “antigravitational development” and spontaneous movement of the child, leading to general lethargy.

Furthermore, this reclining position is liable to cause an abnormal reflex pattern (ex. opisthotonus, extention pattern, ATNR) for hypertonic children, whereas hypotonic children are apt to be immobilized in a “leaning back” position.

Observing the normal motor development of an infant, anti-gravitational position should be aquired in the following order; on elbows, on hands, all fours, sitting and standing. Therefore, the process of accommodating the natural anti-gravity position should be based on the “prone position”. From this perspective, we have been developed a number of seating systems and mobility aids for children with CNS disorder.

Fig-1 The T.F.I.P. Approach

DEVELOPMENT OF "T.F.I.P." THEORY

The Pochi-Roll

This dog-shaped seating device named "Pochi" was designed for children with mild disabilities. Features are simple compared to other seating devices, and it also includes appropriate functions for facilitating sitting position. The roll of dog's torso supports the chest and underarm of the child. The height of the roll can be adjusted from 305mm to 420mm. The roll's inner area between the head and the hip helps to control the child's retraction. The shoulder supports and the back strap were added to the roll for some cases with the severe retraction of the shoulder. While using Pochi, for the child to maintain an upright position, and to reduce abnormal pattern, it is necessary for him/her to sit on a cushion.

It should be said that Pochi's advantage is that virtually all children can sit on the floor without any special devices.

The Rider Chair I (Saddle type)

This chair was designed for children with hypertonicity and extension patterns. One of the best positions for these children is flexion virtually to 90° angle of the hip and sufficient flexion of the knee. While sitting on this chair, the child maintains this position which effectively reduces his/her hypertonicity.

The saddle shaped seat is designed to support the hipbone and also to abduct the child's hip. The knee support which can be adjusted back and forth, hold the child's knee and lower limbs in place. The chest support, which is mounted on the top of the vertical pole, is made of Sub-orthoren plastics and Urethane foam. The flexibility of this support allows attaching the straps, which are both end of support, and also molding of the chest support to the child's torso. The table separated from the chair has a height adjustment from 460mm to 600mm (Fig-3).

Fig-2 The Pochi-Roll in use

Fig-3 The Rider Chair I (Saddle type)

The Rider Chair II (Roll type)

This chair was particularly designed and developed for a 11 year old girl with Cerebral Palsy, spasticity of the limbs and hypertonicity of the trunk (Fig-4). Basic positioning of this chair is the same as Saddle type, but the purpose is to activate the antigravitational muscle tone and also to keep the back straight. The roll seat has the function of abduction the child's hips. To support the hip-bone, the plastic molded seat is attached to the roll. As the height of this roll is adjusted, the child is assisted in taking an appropriate T.F.I.P.. For the caretaker, transferring the child in this chair may be slightly difficult, therefore the table slides back and forth making the child's accessible.

In general, because of the Japanese

Fig-4 The Rider Chair II (Roll type)

life style exists on a "TATAMI" mat floor, these seating devices, Pochi-Roll, Rider Chair I and II provide an appropriate "eye-level" view of the child utilizing the chair in his/her everyday life.

The Anterior Tilting Chair

The basic feature of this chair is the same as the reclining chair i.e. 90° angles are maintained (1) at the seat and backrest and (2) at the seat and the leg-rest. This chair can tilt in sequence by 10° anteriorly and 45° posteriorly. The child sitting in this chair can benefit from both T.F.I.P. anterior sitting, and from the reclining position, keeping the hip and the knee flexed at 90°. The knee support has two important function; one is the anti-thrust function for the pelvis position in anterior sitting, and the other is to keep the hip joint

abducted. Using the appropriate knee support reduces the extension pattern and facilitates asymmetric pelvis placement.

This 8 year old child sitting in this chair (Fig-5) is a CP, tension athetoid type, quadriplegic. Because of intermittent severe hypertonic spasm, it was difficult for her to sit comfortably in any conventional chair. However, this Anterior Tilting Chair helped to reduce successfully her hypertonic pattern in the 10° anterior tilting position.

We think this chair is able to provide one of the best seating for children with severe CNS disorders.

Fig-5 The Anterior Tilting Chair

The SRC Walker

We apply the TFIP theory to the mobility aid named SRC Walker (Fig-6). The primary purpose of this Walker is to draw out the latent abilities of the child with severely involved disabilities. The

Fig-6 The SRC Walker

main components for positioning of the Walker are the chest support, the molded seat and the clear table, which is individually sized. The chest support mounted on the table is made of plastics and Urethane, thus this support fits around the child's trunk by attaching the strap on both ends of the support. Two types of seats are available. One is the standard plastic molded seat, which is designed saddle-shape for stabilizing the child's pelvis and smoothing the locomotion. The other is custom molded seat which is individually fabricated for each child. For several cases with severe deformities, a total contact seat which molds chest, trunk and pelvis was created (Fig-7).

The height of chest support and the seat is individually adjustable, and

Fig-7 The SRC Walker with a molded seat

For severely disabled children, to move by themselves increases their physical and psychological motivation. The SRC Walker was designed and provided for 36 children with severe CNS disorders. Only two cases were unable to use this Walker, because of their severe opisthotonus and immobility. However, an increase in playing and living independently within the facility and the school was realized in 28 cases.

They wanted to use the SRC Walker in all their daily activities.

Fig-8 The SRC Walker in use

its angles can be adjusted within the vertical position and 45° to the ground, keeping a 90° angle between the seat and chest support. Therefore, the child sitting in the walker can maintain a tilting angle from 0° to 45° anteriorly.

The cutout table has an important function of providing support of the upper extremity. For positioning the upper extremity of the child with abnormal tonic pattern e.g. ATNR, retraction, pegs, bars, and wrist straps should be added.

When the child is able to take an appropriate TFIP using this walker, he/she may move lower limbs and kick the ground. This position enables the child to kick the ground backward, therefore the child can step forward (Fig-8).

Conclusion

The result of these approaches confirm that the Trunk Forward Inclining Position or as we have been calling it T.F.I.P. provides one of the best methods for positioning the child with CNS disorders in seating and mobility.

The TFIP theory is still in its developmental stage and it will be necessary to verify this theory by performing scientific research from interdisciplinary viewpoints.

Reference

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