

Deep neck flexor exercise to improve physical performance for people with cerebral palsy

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Introduction

Cerebral palsy is defined as a disorder of movement and posture that develops from non-progressive lesions that can be caused by injury to the developing fetus and infant's brain; it is not a disease, so its clinical features are similar to a common syndrome.¹ The immature brain's development triggers constraints on their activities, and permanent obstacles to attitude development and movement. In addition, nerve palsy at the injured site can create problems with sensation, language, cognition, behavior, musculoskeletal system disturbances in the coordination between different muscles, and sensory organ coordination.² Thus, sufferers often lack the ability to maintain posture through normal movement.^{3,4}

In the normal development process, the baby can pull their chin and head up, in a lying posture at six months of age. This signified that anti-gravity flexor muscles that regulate head control have developed.⁵ However, children with cerebral palsy who have not experienced normal development show a poor ability to control their head, and head control is essential during the young children's development, in this way, it will not permit effective posture adjustment, and children cannot perform normal movements in all postures.⁶ Moreover, excessive extension posture in the neck and stooped trunk posture shortens sufferers' posterior neck muscles, sustained posture creates weakness in the posterior neck muscles, it is difficult to keep the head in a space, the arms are too heavy for movement, and the hands and eyes move separately.⁶ Therefore, maintaining balance and posture is very difficult for children with cerebral palsy.⁷

Head regulation intervention is indispensable for improving posture control with cerebral palsy, and the role of the deep neck flexor muscles to maintain posture control and neck stability have been emphasized recently.⁸ The deep neck flexor muscle shows a relatively large amount of muscle spindle distributions compared with other muscles, and can require high Proprioceptive function.⁹ Proprioceptive sensation plays an important role in maintaining posture to teach information about position sense and relative body orientation with regard to the ground, and intervention for that is positive for the maintenance of posture in cerebral palsy children.¹⁰

Deep Neck Flexor Muscle Exercise

The deep muscles of the neck include the cervical muscles longus colli, longus capitis, rectus capitis anterior, and rectus capitis lateralis, and other muscles in the anterior, and the spinalis cervicis, multifidus, suboccipitalis, and others are involved in the posterior; these muscles are involved in stabilizing and supporting the neck.¹¹ Most children with cerebral palsy show a posture side flexion posture or forward flexion posture due to the lack of trunk stability. In particular, it is observed from the posture when bending forward from a body sitting position that this induces excessive neck extension, which reduces its stability.¹² Therefore, the longus colli and longus capitis muscles

acting as antagonists of the neck extensor muscles are emphasized.⁸ These muscles perform a similar dynamic function, provide vertical stability for the neck, and serve to support the anterior of the base of the neck and support and fix each joint.^{13,14} In particular, the deep cervical flexion muscles are lower than to cooperate effectively to generate strong muscle contraction force to support the weight of the head while maintaining the correct posture of the neck and moving the head. They play a role in supporting and fixing the neck by providing strong static muscle endurance and stability.¹⁵ Recently, the activation of the cervical flexor muscles have been proven to have a positive effect on the improvement of the abdominal muscle thickness, dynamic and static balance ability, and Proprioceptive function of children with cerebral palsy.¹⁶

Balance

Posture control gains stabilization with the ability to adjust the position of the body in space, and balance adjustment means the ability to maintain the center of gravity of the body at the minimum posture fluctuation on the support surface.^{17,18} In particular, in the course of normal development, the development of the ability to locate the head of a child in space is very important.^{19,20} However, the head-regulating ability of children with cerebral palsy is lowered due to the congenital disease, and the stabilization movement of the neck is applied through intervention against this. When stabilizing the neck, improving the stability and control ability of the head through strengthening the deep cervical flexor muscles and continuing sensory feedback to improve the stability of the neck in a static balance will have a positive influence.²¹ As well as looking in another research of Soh et al.²² the stabilization movement of the neck showed improvements in the functional reaching test(FRT), timed up and go(TUG) expressing dynamic balance ability and Berg balance scale(BBS).^{16,22} Therefore, the exercise of neck stabilization is positive, and it can be applied to the intervention method for improving the dynamic balance ability.

Trunk stability

Stability of the trunk is the ability of the musculoskeletal system to

maintain a balance that is displayed as a small exercise or a distraction of movement.²³ Children with cerebral palsy have undergone an abdominal development process and the stability of the trunk will be reduced.²⁴ including not only the balance while sitting, but also decreased walking ability and upper-limb function. Therefore, the medial muscle of the body requires mediation of the neck flexion movement of a child with cerebral palsy and also has a positive effect on the stability of the trunk. The neck flexion exercise secondarily activates the muscle contraction for the stabilization of the ventral trunk muscles and contributes to the automatic adjustment of the trunk.²⁵

Body alignment

Regarding the posture of those with cerebral palsy, the trunk is bent forward and the head is excessively stretched; thus, the forward movement posture of the head due to the changes in head position can result in deep cervical flexor muscles thickness changes, such as the longus colli muscle.²⁶ In particular, if the deep flexor muscles, the longus colli and longus capitis, are weakened and the ability to adjust the head decreases, the superficial muscles, the sternocleidomastoid muscle and anterior scalene, are activated early and excessive chin and head movements are displayed, causing hyperextension in the superior cervical vertebrae.²⁷ If these incorrect posture behaviors persist chronically, the disc of the cervical spine will be pushed and muscle shortening between the atlas and axis will occur, resulting in permanent deformation of the posture. Therefore, it is important to maintain proper alignment, and stabilization of the neck may be an effective intervention for this.

Conclusion

According to the above research results, it can be seen that strengthening the motion of the deep cervical flexor muscle has a positive effect on the static and dynamic balance ability of cerebral palsy children, contributing to the stabilization of the trunk. Therefore, it is concluded that it is necessary to verify the intervention effect in various environments through continuous research.

Acknowledgments

None.

Conflicts of interest

None.

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