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"Case study: A Systematic Trunk Control method for Cerebral palsy affected Children's"

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Abstract:

Cerebral palsy (CP) is a complicated disorder that results from immature brain injury, with the key facets of limitations and impairments of postural controversy in movement.The risk factors associated with this are hard to quantify and explain.Proposed work focuses on the health care therapy which focuses on multi-posture, modular system that makes it easier for people suffering from cerebral palsy to practise the exercises and activities necessary, thereby enabling their cognitive growth to be enhanced. The system consists of a collection of components of various shapes that adapt to the individual's measurements and ensure that the objects body is aligned at main cluster centres like head, trunk, establishing alignment at the level of the shoulders, elbows and internal organs.

Keywords: Cerebral palsy, Posture, fetal hypoxia, Rhesus-factor.

I. Introduction

Cerebral means brain is impacted, and palsy means loss of muscle function. Cerebral palsy (CP) is a state of movement and body location, an occurrence that occurs secondary to the development of the brain. It is also known as infantile cerebral paralysis (ICP), which plays an important role in serious conditions in children and young adults.Cerebral palsy is a childhood muscle disorder condition which affects the ability of a person to

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move and maintain balance and posture. It is influenced by irregular brain development or brain injury that inhibits the ability to regulate the muscles of the developing brain. The particular cause is uncertain [1].

It is one of the most common childhood congenital disorders.There are common signs of cardiac arrest, speech and communication disorders and developmental disabilities in children suffering from cerebral palsy. Posture is the body's presumed attitude, when the body is stationary or when it moves. Complex interactions of musculo - skeletal and neuronal systems produce the continuous adaptations of body posture required for the execution of functional activities and are characterized as postural control. In most cases, disruption of muscle tone along with a pathological tonic stretch reflex that accompanies the disease gives rise to pathological settings of the limbs with subsequent development of contractures, which significantly complicates the kid's collection of new motor skills [2].

The new definition of cerebral paralysis will not illustrate the variety of pathological conditions and causative factors associated with cerebral paralysis, which include, first of all, chronic fetal hypoxia, intrauterine infection and foetal rhesus-factor incompatibility of the mother and foetus, and hydrocephalus with the development of corresponding pathogenesis elements in the form of rhesus-factor foetal paralysis. This determines the need for care based on the specific pathological settings defined and the objective description of the elements of pathogenesis for further treatment.Medical intervention of cerebral paralysis, accompanied by tendon increasing the length of the spastic muscle, is painful and involves prolonged postoperative insertion in the form of plastering, leading to contracture development and atrophy of the muscles[3].Cerebral paralysis is described as a series of defects that can impair brain and nervous system function (including movement, listening, and hearing, seeing, and thinking). There are many types of cerebral palsy, including cerebral palsy that is spastic, dyskinetic, ataxic, hypotonic, and mixed-counted.The reasons of cerebral paralysis differ from person to person, so they cannot be linked to a single factor, although they all develop poor Central Nervous System **(**CNS**)** maturation as a common determinant. In both the prenatal and perinatal or postnatal period, cerebral palsy may occur, limiting manifestation after the first five years of life[4][5].

There is currently no cure for cerebral paralysis, but the goal of therapy is to encourage the person to be as independent as possible, to enhance motor skills, cognitive growth and to achieve the highest possible level of physical development and social integration of those affected [6]. Specifically, these therapies focus on three key lines of action: The treatment of motor disorders, the prevention or reduction of motor effects on overall human growth, and the treatment of related disorders.The prior art is acceptable for people with disabilities; it is not intended for individuals, particularly for people with cerebral paralysis. The chair does not permit distinct sitting and resting positions in that context. This design does not allow exercise positions such as pronation, supination, or inverted pronation to be created. Likewise, no insurance or secure control heads and upper and lower extremities are required for the build. And there is also a need for a dynamic system which responds and communicates with the patient as well. [7**]**.Various risk factors associated with cerebral palsy have been illustrated in the below figure 1, which gives overview about where kids get affected by cerebral palsy.

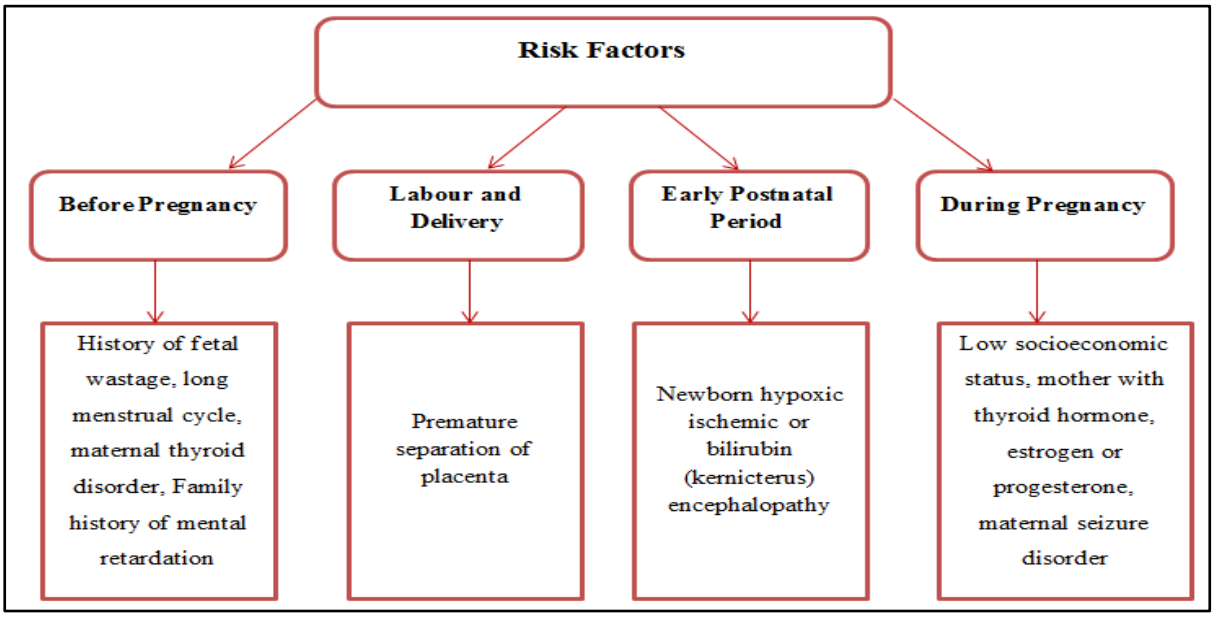

Figure 1: Risk factors associated with Cerebral palsy (CP) with different stages.

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II. Literature Survey

According to Mahendra Ranaet.al [8]**.**, the recent literature on aetiology, epidemiology, and advances in CP were considered. A Cerebral Palsy research review presents an exceptional opportunity to consider the risk factors associated with this condition as well as their frequency and prevalence. A very difficult process is the treatment and management of CP in a person. While healthcare practitioners have used a variety of clinical methods, empirical research has confirmed the effectiveness of just a few. They have considered the causes as well as risk factors associated with this condition to avoid the chances of Cerebral Palsy.

Erich Rutzet.al [9]explains by considering primary outcome measure, the Gait Profile Score (GPS) is clarified. The authors focused on the stabilisation following single-event multilevel surgery in children with bilateral spastic CP. Conflicting findings exist regarding the stability of the Gross Motor Function Classification System (GMFCS) in children with cerebral palsy following orthopaedic surgery (CP).Retrospective cohort analysis of bilateral spastic CP was the approach they focused on. GPS was the primary indicator of the result. Changes in the amount of GMFCS were studied before and after intervention at several points in time. The increase in GPS by comparing it with several different situations was three times the minimum clinically relevant difference.At many points in time, shifts in the amount of GMFCS were studied before and after intervention.

Authors Vasileioset.al [10] describes the most common type of CP as Spastic Cerebral Palsy (CP). Spasticity is a kind of hypertonia that presents as complex contractures clinically. In a child with CP, the dynamic contracture along with the decreased degree of body hobby contributes to secondary structural and morphological changes in spastic muscle, causing real musculo tendinous shortening, known as fixed contractures.Constant muscle contractures are not resolved by early, progressive development of musculoskeletal deformities, highlighted by researchers. Thus, CP orthopaedic surgical management has progressed from previous "multi-occasion unmarried stage" approaches to "unmarried event multilevel" strategies, with adjustments in the selection and implementation of remedy modalities that prove that multi-level surgery is a crucial and essential part of spastic CP spastic therapeutic management.

Helga et.al[11] indicates the spastic paresis (SP) of the infant, where the semitendinosus muscle (ST) is frequently lengthened by surgery, but with varying efficacy, to increase the range of motion of the knee and boost gait, among other hamstring muscles. Nothing is known about how the ST muscle's pre-surgical mechanical and morphological features differ between children with SP and children who typically develop (TD). The aim of this analysis was to investigate how the characteristics of the knee moment-angle and ST morphology differ from TD kids with SP selected for medial hamstring lengthening, as well as how the characteristics of the knee moment-angle and ST morphology are related.

Authors H. Kerr Grahamet.al [12]explains the clinical manifestations of cerebral palsy, it indicates the degree of cognitive capacity and limitation, and the affected areas of the body. There is no cure, but progress is being made in both preventing brain injury and reducing it. Although the disease affects individuals throughout their lives, most cerebral palsy research activities and treatment strategies are currently focused on the needs of children. The goal of clinical treatment of children with cerebral paralysis is to increase development and participation in activities and to mitigate the effect of factors that may make the disability worse, such as epilepsy, eating disorders, hip dislocation and scoliosis.These treatment strategies include enhancing neurological function through early development; managing medical co-morbidities, fatigue and hypertonia; using rehabilitation methods to optimise motor function; and preventing secondary musculoskeletal problems. Meeting the needs of people with cerebral palsy in resource-poor settings is especially challenging.

III. Methodology

The kid's enhanced success would be rewarded with visual and auditory responses.Individuals with CP whose physical impairments prohibit walking can need multiple devices to help them get around.It has become possible to build advanced wheelchairs since the advent of the computer era, which can give mobility back to those with impaired motor control.Because of the switch technology and other special controls, if someone has CP and cannot manually propel or steer the wheelchair effectively, they can still make movements. One or more illnesses that require urgent care and treatment may be endured by testingkid. Patients with one or more diseases associated with one or more test may be assisted by the system, where information contains data needed to identify one or more diseases.
The system may provide remedies corresponding to the one or more disabilities using Assistive devices. The trunk control system may generate and transmit a message to a user device based ontrunk control training. The Assistive device and the user device are coupled using a network. The network may include the Internet for performing the communication between devices as shown in figure 2.

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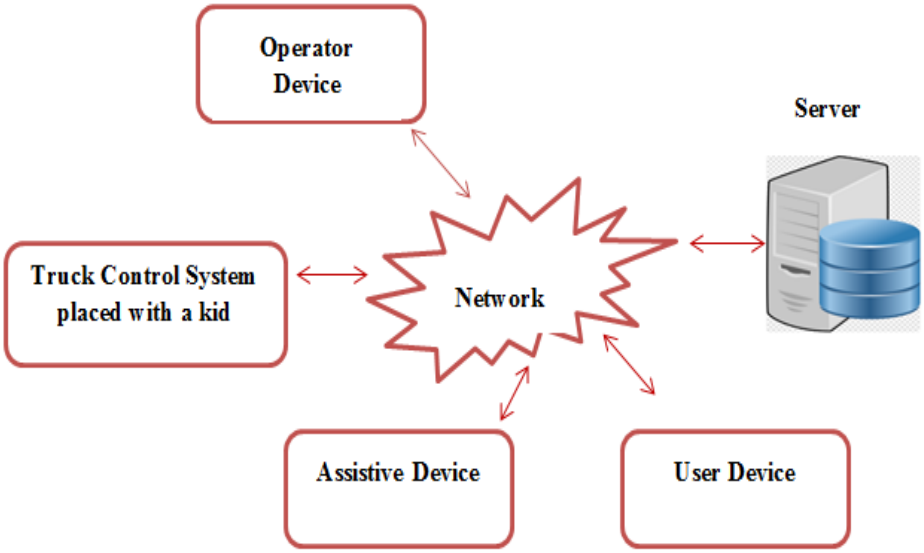

Figure 2: Components of trunk control system

A hardware linked to a platform may be responsible for obtaining readings of the actions of the kid. It can include Gyroscope Sensor, Bluetooth Module. It may also produce a control signal based on information from the trunk control to provide the appropriate reflex action for the action of the kid. Based on the produced trunk control signal, it generates static trunk control and/or dynamic trunk control.

(i) Static trunk control

Based on the inflatable jacket associated with the device, static trunk control is allowed. All the parts of the jacket will be inflated and the trunk of the CP kid will be stabilized from all sides and by showing some cartoon photos on television, the kid is made to sit passively. The passive support is removed progressively after a few days of passive sitting (to teach the brain, muscle & joints to learn the correct posture) and the kid is encouraged to sit actively as shown in figure 3.

Case-1: To activate trunk spinal extensors

The protective anterior part of the jacket is eventually deflated, resulting in the kid leaning/bending over, and the cartoon picture begins to vanish proportionally. The kid must maintain an upright sitting pose in order to prevent the cartoon image from disappearing. The kid must enable its spinal extensors to resume and retain the erect posture, so that the forward bending trunk is eventually returned to the erect posture and the kid is rewarded with the cartoon image shown on the screen again.

Case-2: To activate trunk spinal flexors

The jacket's supporting posterior section is eventually deflated, causing the kid to fall backward and the cartoon picture begins to vanish proportionally. The kid has to lift himself up to maintain an upright sitting pose to keep the cartoon image from vanishing. The kid must enable its spinal flexors to resume and retain the erect posture, so that the backward bending trunk will be eventually returned to the erect posture and the kid will be rewarded with a cartoon image shown on the computer.

Case-3: The lateral flexors and rotators of trunk also will be activated on the similar principle.

Figure 3: Kid watching cartoon show

(ii) Dynamic trunk control

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The device communicates through the network with the operator's equipment to enable dynamic trunk control once static control is achieved to a certain degree. Usage of peripheral equipment in order to provide additional dynamic trunk control support.Devices that regulate a Kid's system can monitor one or more test and one or more test may be individuals affected by cerebral paralysis. Kids may suffer from one or more diseases which require critical care and treatment.

3.1 Working principle of Trunk control system

The procedure as shown in figure 4, includes obtaining trunk control information, from the trunk control system associated with a kid. All setup in turn connected to the internet.

Step-1: Setting up connectivity with operator device, control system present with a kid, user device and Assistive devices.
Step-2: Execution with the help of the trunk control system and the operator device. Output will be the traits of a cerebral palsy affected individuals.
Step-3: The method includes generating trunk control signal based on the trunk control information. This will be executed by the system in the step-1 with the help of the processor and memory.
Step-4: Based on the generated information classify static or dynamic trunk control.
Step-5: Study the behavior of a kid by taking the feedback after the classification. Behavior here may be inflating/ deflating a jacket supporting the victim. The data transmission between the hardware unit and software unit may be executed via a wireless network.

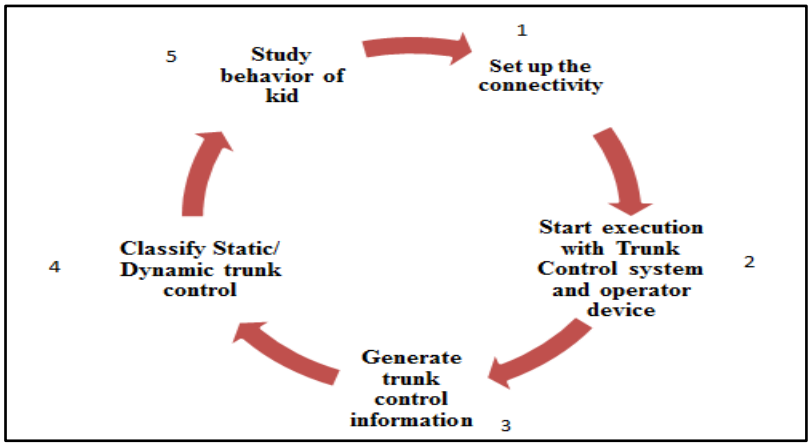

Figure 4: Work flow of Trunk Control system

IV. Conclusion

The current invention provides a trunk control training system for individuals, especially for children. The trunk control system consists of at least one memory configured to store instructions and at least one processor configured to execute instructions from a related trunk control system to obtain trunk control information, produce trunk control signal based on trunk control information, and provide static trunk control and/or dynamic generator-based trunk control.The device can be assisted by patients with one or more illnesses associated. One or more disabilities may be neurological disorder caused by non-progressive brain development damage-either before/during/after birth, trunk control device with inflatable jacket attached to facilitate static and dynamic trunk control in CP children.

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