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Review

Effect of absence of vision on posture

Abdullah Z. Alotaibi, PhD[1)], Ahmad Alghadir, PT, PhD[2)], Zaheen A. Iqbal, PT, MPT[2)*], Shahnawaz Anwer, PT, MPT[2, 3)]

[1)] *Department of Optometry, College of Applied Medical Sciences, King Saud University, Saudi Arabia*
[2)] *Rehabilitation Research Chair, College of Applied Medical Sciences, King Saud University: PO BOX 10219, Riyadh 11433, Saudi Arabia*
[3)] *Dr. D. Y. Patil College of Physiotherapy, Dr. D. Y. Patil Vidyapeeth, Pune, India*

Abstract. [Purpose] The visual system is one of the sensory systems that enables the body to assess and process information about the external environment. In the absence of vision, a blind person loses contact with the outside world and develops faulty motor patterns, which results in postural deficiencies. However, literature regarding the development of such deficiencies is limited. The aim of this study was to discuss the effect of absence of vision on posture, the possible biomechanics behind the resulting postural deficiencies, and strategies to correct and prevent them. [Subjects and Methods] Various electronic databases including PubMed, Medline, and Google scholar were examined using the words “body”, “posture”, “blind” and “absence of vision”. References in the retrieved articles were also examined for cross-references. The search was limited to articles in the English language. [Results] A total of 74 papers were shortlisted for this review, most of which dated back to the 1950s and 60s. [Conclusion] Blind people exhibit consistent musculoskeletal deformities. Absence of vision leads to numerous abnormal sensory and motor interactions that often limit blind people in isolation. Rehabilitation of the blind is a multidisciplinary task. Specialists from different fields need to diagnose and treat the deficiencies of the blind together as a team. Before restoring the normal mechanics of posture and gait, the missing link with the external world should be reestablished.
Key words: Absence of vision, Blindness, Body posture

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INTRODUCTION

Posture has been referred to as a “psychosomatic affair”, as its stability is the key to maintaining balance of the body[1, 2)]. The visual system is one of the main sensory systems that enables the body to assess and process information about external factors, such as relative positions of body segments[3)], and to adjust posture according to need[4, 5)]. Absence of vision leads to deficiencies in posture due to inadequate interaction with the environment[6)] and affects normal patterns of gait[7, 8)] and balance[9)]. In order to compensate for faulty gait, postural abnormalities further develop[10, 11)] creating a vicious cycle.

Although the population of blind people is on the rise, to the best of our knowledge, literature regarding their postural deficiencies is limited. There are few articles that have researched the etiology and pathology of postural deficiencies that develop in this population. The aim of this study was to discuss the effect of the absence of vision on posture, possible biomechanics behind the resulting deficiencies and strategies to correct and prevent them.

SUBJECTS AND METHODS

A literature search was done of different electronic databases including PubMed, Medline and Google scholar. Key words used were “body”, “posture”, “blind” and “absence of vision”. References in the retrieved articles were also examined for cross-references. The search was limited to articles in the English language.

*Corresponding author. Zaheen A. Iqbal (E-mail: z_iqbal001@yahoo.com)

RESULTS

After the elimination of 25 duplicated papers, 74 papers were shortlisted for this review (Table 1). The majority of these studies were published in 1950s and 1960s. Of late there have been no reports or reviews about the occurrence of postural deficiencies or their etiology, or the biomechanics of blind people. In the following section we discuss about the biomechanics and etiology of such deficiencies along with strategies to prevent and correct them.

DISCUSSION

Vision is important for the development of postural reflexes[3]. A blind child develops abnormal postural reflexes and faulty motor patterns, leading to incorrect distribution of muscular force throughout the body[1] which precipitates postural and balance deficits[12, 13]. For blind subjects, half of the normal sensory intake of the brain is lost[14], disrupting the normal mechanism of neurological integration and disintegration, and preventing the formation of good postural habits[7, 15]. There is no 'hand to eye' connection and dual tasks of perception as well as execution have to be performed by the hands[16]. Although the tactile and auditory senses are developed[17], they are of less help in maintaining biomechanics.

Loss of vision affects the body mechanics through loss of sensory feedback, which results in imbalance and loss of protective reflexes[18]. Posture and mobility go hand in hand[19]. To maintain equilibrium, the gait of a blind person deviates from normal[8]. Deviation in normal gait starts with retraction of head and includes increased pelvic rotation, excessive backward leaning of the trunk with dorsal kyphosis, compensating forward head posture, abnormal contralateral trunk and arm movements, and flexion contractures[7], all of which lead to faulty body mechanics[11]. This is achieved naturally by compensation in the development of posture[11, 12].

Vision continuously provides information about location and the position of the body in space to the brain, and has an important role in the body's stabilization[20]. In the absence of vision, postural deformities develop due to various interactions, which result in motor and neurological abnormalities[21]. Blind people exhibit consistent musculoskeletal deformities[2]. During rest they keep their fingers extended[16], showing anxiety. Other postural compensations seen in blind subjects include flat and valgus feet with toe-out and broad base of support, flexion contracture at the hip and knee, dorsal kyphosis, dropped shoulders, retracted and forward head postures, poor muscular development in the legs[7, 16]. Together with the associated loss of spatial orientation and body image these defects become a dynamic problem that often limits the scope of their rehabilitation[21].

Children learn body language by observing their friends and family. Blind children cannot observe and learn such normal mannerisms and exhibit faulty motor patterns through inappropriate gestures, facial expressions, eye movements, lack of coordination in gait (visual ataxia), rigid inability to change position associated with fear, body stiffening (freezing), etc. [7, 10], which further predispose to postural abnormalities.

Absence of vision leads to numerous complex abnormalities that often limit blind people to isolation in their own world[16]. Blind people often exhibit fear and frustration. Repeated incidents of falls and overprotective parents may prevent blind children from developing an independent life. Their educational and social development is also severely affected[22]. Rehabilitation of blind persons should be started at an early stage of life to facilitate their ability to adapt to the environment and to start the learning of measures for coping[23], in order to achieve independence in their activities of daily living. The rehabilitation of blind persons is a multidisciplinary task that should involve specialists from different specialties.

Posture among blind people is natural compensation for their visual deficiency and none of the above-mentioned deficiencies can be treated in isolation[16]. Ideally, postural training should start with re-education of the body's pattern of reaction and coordination[24]. This can be achieved by restoring sensory input either through available sensory systems or use of some prosthesis. The re-establishment of the normal mechanics of gait, and the treatment of acquired orthopedic deformities should be done at the later stages[10].

Training to use available sensory inputs, e.g. hearing for analyzing orientation, is also helpful[16]. Auditory feedback has also been shown to improve postural control[25, 26]. The most important aim of the rehabilitation of blind people is to help them make a 'perceptual contact' with the ground, which can be achieved with the use of a long cane[16]. This prosthesis

Table 1. Number of papers found using different databases

Database	Papers
PubMed	29
Medline	15
Google scholar	20
Cinhal	05
Cochrane library	05

substitutes for the functions of vision and has been widely studied for the prevention of deficiencies in posture and associated gait disturbances among blind subjects[27]. The long cane, developed in the USA by R.E. Hoover and his team to provide safe means of travel for soldiers blinded in the Second World War[16], is used universally. It was designed not to bear weight, but to be used as a sensory tool, which substitutes for the functions of vision by supplying external data related to the contact with the environment, additional feedback and protection, and provides link with the external world[28] in place of vision. The use of non-visual cues, such as transverse markings on the floor, can reduce errors of spatial judgement, especially during turns[3, 29, 30].

After establishing a link with the external environment, postural training should begin to improve mobility skills[19]. Parents and teachers at blind schools should teach blind children about body language to help them communicate with the world.

In summary, the function of vision is to supply data related to contact with the environment, additional feedback and protection, and provides a link with the external world. Absence of vision leads to numerous complex sensory and motor abnormalities that often limit blind people to isolation. Rehabilitation of the blind is a multidisciplinary task. Specialists from different fields need to diagnose and treat the deficiencies of blind subjects together as a team. Before restoring the normal body mechanics of posture and gait, contact with the external world in pace of vision, should be re-established.

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