Key Points

1. Saccades are a type of eye movement which are essential for proper visual function
2. Research has shown that damage to the cerebellum has led to problems with saccades movement; also case studies have been published on Chiari II children with saccades problems
3. Researchers hypothesized that Chiari II children would differ from healthy children when saccades were measured
4. Studied 21 Chiari II children and 39 healthy children
5. As a group, found no significant difference between the eye movements of the two groups, although 3 Chiari children did show some delayed movements
6. Also found NO link between other eye problems, hydrocephalus, or MRI parameters and the eye movements
7. It appears that for at least a subgroup, Chiari II does not effect saccades eye movements

Definitions

brainstem - portion of the brain which connects with the spinal cord; controls many automatic functions such as heart rate, breathing, and swallowing

cerebellar tonsils - portion of the cerebellum located at the bottom, so named because of their shape

cerebellum - part of the brain located at the bottom of the skull, near the opening to the spinal area; important for muscle control, movement, and balance

Chiari malformation - condition where the cerebellar tonsils are displaced out of the skull area into the spinal area, causing compression of brain tissue and disruption of CSF flow

Some Good News For Chiari II Children

Visual disturbances, or eye problems, are common among Chiari patients, and include a range of symptoms such as double vision, sensitivity to light, strabismus, and nystagmus. The results of a new study out of Canada, however, indicate that one important type of eye movement, known as saccades, is generally not affected in children with spina bifida and Chiari II.

Saccades is a voluntary type of eye movement where the eye quickly shifts from looking at one point to another. For example, when children are reading and they move from one line to another, their eyes jump from the last word on the right to the first word on the left of the new line. This is a saccades movement, and is considered essential for proper visual functioning.

The Canadian team of researchers, led by the neurologist Dr. Salman, had hypothesized they would find that Chiari II did indeed affect saccades. Their hypothesis was based on research which has shown that the cerebellum plays a strong role in this type of eye movement. Previous studies have revealed that damage to the cerebellum leads to problems with saccades eye movements, such as delays in the movement, slower movement, and not moving the eyes to look at the correct spot. In addition, Chiari II has been directly linked with impaired saccades in several published case studies.

Based on this background, the Canadian team not only expected to see impaired eye movements in Chiari II children, but they thought they would be able to associate the problems with other characteristics of the children, such as hydrocephalus, brain measurements, and where their spinal lesion was located. What they found however, and published in the June, 2005 issue of the journal Neurology, was quite different.

The research team recruited 21 children with spina bifida and Chiari II and 39 healthy children for their study. To be included in the study, the Chiari children could not have deficits in their visual field that would interfere with the saccades test, have an IQ score above 70 and not suffer from nystagmus in the range that would be tested.

The Chiari children they recruited ranged in age from 8 to 19, and all had hydrocephalus. Five of them had had no shunt revisions, 9 had one shunt revision, and 7 had had two or more revisions. Brain MRI's were available for 19 of the 21 participants, which the researchers used to measure structural.htmlects of the cerebellum.

To test the saccades movements of both groups, the research team used an infrared eye tracker which the children wore like glasses. The actual test was performed in a dimly lit room, with the subjects looking at a white dot on a screen. The dot would randomly move up, down, right, or left. The time between movements of the target also varied randomly between a preset range. The eye movements (only one eye was tested, the other was covered with a patch) were recorded and software was used to identify saccades movements. Specifically, the researchers looked at the number of saccades movements, the speed of the eye movement, the delay before the eye movement, and whether the eye moved to the correct spot.

Surprisingly, they found that as a group there was no significant difference between the results for the Chiari II children and the control group (see Figure 1). In addition, they were unable to find a connection between any of the other parameters, such as number of shunt revisions or MRI measurements, and the saccades results. It should be noted however, that individually, three of the Chiari II children did have some problems with long delays as compared to the control group. Interestingly, two out of these three children also had nystagmus, although it was not triggered during the saccades test.

Figure 1
Selected Saccades Test Results For Chiari and Control Groups

Dir.	Value	Control	CII	Sig?
Right	Avg. #	26	25	N
	Avg Speed	521	485	N
Left	Avg. #	26	25	N
	Avg Speed	537	539	N
Up	Avg. #	30	31	N
	Avg Speed	467	421	N
Down	Avg. #	28	29	N
	Avg Speed	436	456	N

Chiari II malformation - condition similar to Chiari I, but potentially more serious, where more of the brain than the cerebellar tonsils is displaced out of the skull, many physicians reserve the term Chiari II for Chiari associated with spina bifida

control group - in an experiment, a group of subjects which is used as a basis for comparison

cranial nerves - 12 pairs of nerves that start in the brain itself versus the spinal cord

hydrocephalus - condition where an excess of spinal fluid collects in the brain area; many children with spina bifida also have hydrocephalus

nystagmus - involuntary, rapid eye movements

saccades - type of voluntary eye movement which quickly relocates the eye from one position of focus to another; essential in childhood reading

shunt - implanted, tube like device used to drain, or divert, spinal fluid from the brain

spina bifida - birth defect where the spinal cord doesn't seal properly; about 30% of spina bifida children also have Chiari II

strabismus - condition where the eyes do not move in parallel; cross eyed, or lazy eye

Source

Salman MS, Sharpe JA, Eizenman M, Lillakas L, To T, Westall C, Steinbach MJ, Dennis M. Saccades in children with spina bifida and Chiari type II malformation. Neurology. 2005 Jun 28;64(12):2098-101.

Notes: Avg # refers to average number of saccades eye movements; average speed is in degrees/second; sig? refers to whether the difference between the control group and the Chiari group is statistically significant

The authors conclude that Chiari II in general does not interfere with the important saccades movement of the eyes. This could be because the parts of the cerebellum which control that type of movement tend to not be affected, or it could be that the brain compensates for any initial loss of ability. The authors do concede that their finding may not apply to all Chiari II patients because their criteria for inclusion in the study (IQ better than 70) resulted in a group that might not be affected as much as others.

Despite this, and the many eye problems associated with Chiari, it does appear that for at least a subgroup of children and their families, there is one less thing to worry about.

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