OPHTHALMIC SCOLIOSIS[1]

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A Consideration of a Probable Causation in Scoliotic Conditions of Children

Ophthalmic or glare-induced scoliosis, as differentiated from empyematic, habitual, inflammatory, myopathic, osteopathic, or paralytic scoliosis is, for the purpose of this paper, a curvature of the spine attributed to excessive light striking the peripheral retina of the eye and producing an interference with the light from the working materials focused on the fovea. This condition has, as a major concomitant, the irregular lighting of the classroom. It is not to be thought that this adaptation of the organism to an environment is something entirely new or relevant to a particular geographical location, for it can be observed in any classroom, regardless of where it may be.

In order that one may visualize the condition which is the topic of this paper, it is necessary to recall the appearance of a group of pupils say, in the fourth grade, writing a composition. The children are bent in various directions over their papers, some leaning on elbows, others with their heads askew from the horizontal seating position. Again, the spine may assume an "S" shape while the head completes an angle of incidence counter to the position of the atlas. It appears possible that illumination (for instance, glare spots in the field of vision) is a forcefully contributing factor to a condition of visual fatigue and has as a probable resultant, ophthalmic scoliosis (Ferree and Rand 1918.)

The room in which these measurements were made had six rows across and contained nine seats in each row, 54 children in all. For purposes of this study, this schoolroom area was broken up into sections, section 1 including rows 6 and 5, seats 1 to 3, inclusive, for both. Section 2 included two rows of the same numbered seats on the opposite side of the room. Section 3 included rows 4 and 3, with seats 4, 5, and 6, inclusive, for both of the rows. Section 4 was for rows 6 and 5, with seats 7 to 9, inclusive, for both rows in the corresponding section on the opposite side of the room. Row 6, as will be noted from figure 1, was adjacent to the windows of the room, while row 1 was the most poorly illuminated area in this room. These facts should be remembered in considering data on the head and body rotations which follow in the summary table. (Refer to figure 1 for further classification.)

Table I summarizes the degrees of rotations, both lateral and ventral-dorsal, i. e., physical postures, of the children of the various sections of the room, along with the corresponding intensities of illumination. It is important to note that in proceeding from section 1 to section 2 in the summarizing table, the angle of lateral rotation of the head changes from 35° to 17°, and in the angle of the ventral-dorsal rotation of the head the difference is from 31° to 18°. One may tentatively conclude from this significant difference that the amount of rotation is directly proportional to the

[1]Read before the Psychological Section at the American Association for the Advancement of Science meeting, Dallas, January 1942.

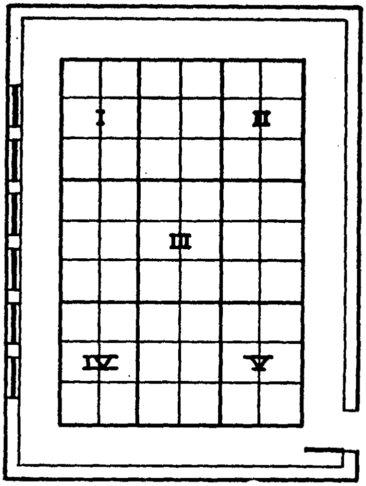

FIG. I

illumination. Rotation from section 4 to section 5 expresses, on an average, the same amount of distortion as was found for section 1 to section 2. Thus the angle of lateral rotation of the head in section 4 is 26°, while that in section 5 is 13°; and the ventral-dorsal angle of rotation in section 4 is 41°, as compared to the angle of the ventral-dorsal rotation of the head in section 5, which is 33°.

TABLE I

Physical, environmental, and postural measurements
(54 pupils in lower fourth grade, Corpus Christi, Texas)

Sec.	Illumination at Desk surface plane	Reading plane	Eye plane	Reading plane	Reading dist. pref.	Off center	Head	Trunk	Head	Trunk
	fc[1]	fc	fc	angle	in.	in.	angle[2]	angle	angle[3]	angle
1	77	61	128	45°	8	4	35°	29°	31°	36°
2	16	13	42	25°	11	5	17°	15°	18°	10°
3	28	23	81	34°	6	5	L28°	23°	27°	24°
4	80	56	125	43°	6	4	L26°	28°	41°	33°
5	12	6	59	16°	11	5	13°	11°	33°	14°

[1]Foot candles.
[2]Lateral rotation, R-L, through pelvic region.
[3]Ventral-dorsal rotation through axis of iliac bones.

Neurological Interpretation. Neurologically, a curve of the spine as a resultant of visual stimulation may be explained partly by the neurobiotaxic hypothesis of dendrite extension which, as Kapper states, is that "Dendrites grow toward an active neuron or nerve bundle, providing that the neuron from which the dendrite grows and the neuron toward which it grows are in excitation simultaneously or in close succession," (Kappers.

C. U. A. 1921, 1932, 1934) and, perhaps, completed with the inclusion of the hypothesis of stimulogenous fibrillation (S. T. Bok), which attempts to account for axon growth from a point of stimulation.

On the other hand, one might raise the question: Is this a problem to be explained by neurophysiology? Could not the asymmetrical body patterns be explained as a matter of activity of the musculature unilaterally supporting the head? We know that activity promotes growth, and thus in this instance of unilateral stress, one muscle might hypertrophy and so produce a constant unbalanced traction on the spinal supporting ligaments which results in a spinal curvature. For example, a child exposed to excessive peripheral retinal stimulation may first rotate the body to avoid the points of glare striking his eye from such extraneous sources as reflective materials in the classroom or sky illumination from uncontrolled origins. The rotation of the body, coupled with the fatigue elements of supporting the head (the visual plane) in a vertical position to the spine which is, under these conditions, off center, allows for unilateral relaxation of the longissimus capitis, sternomastoid, sternocleidomastoid, and trapezius muscles which extend, abduct, and rotate the skull. In turn, the head approaches the plane of the working materials as fatigue becomes more and more severe. Instead of the child's maintaining a refraction which should be emmetropic, the axis of the eye is lengthened (the rays being focused in front of the retina) and myopic vision is the result. One may argue that this is functional myopia and not true myopia. That is true, but should this condition of simulated myopia continue over a long period of time, functional disability may become an organic lesion.

It is not to be interpreted that the condition which has been defined as ophthalmic scoliosis is definitely proved to exist, but this paper is an attempt to present materials which might contribute to a scoliotic condition in children.

It is the opinion of the author, who has had an opportunity to investigate a large sampling of Texas children from the primary to the secondary level, that the scoliotic condition increases in severity with the maturation of the individual. The responsibility of the research rests upon the continued investigation which the author is now undertaking.

SUMMARY

Results obtained from one grade studied intensively, namely, the fourth grade, indicate that the lateral and ventral-dorsal rotations decrease with the decrease of brightness areas in the line of the visual plane. These results must not be interpreted as being conclusive or indicative of an invariable condition.

The evidence presented suggests not only the prevalence but the severity of ophthalmic scoliosis. Its correction, if correction is to be secured before the scoliotic condition becomes an organismic reality by induction of dysfunctional stresses, may be found in equalized illumination of classrooms, particular attention being given to such conditions in the lower grades.