



Postural Dysfunctions and Strabismus: Correlations

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Authors' contributions

This work was carried out in collaboration among all authors. Author LS designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors GM and FG managed the data collection, the analyses of the study and performed the statistical analysis. Author MC managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Purpose: Patient with strabismus may assume a compensatory posture. Posturology treats patients with abnormal head position through the stimulation of foot, ocular and stomatognathic receptors. As an alternation of one or more receptor occurs, the tonic postural system seeks to carer for this problems by adopting compensatory postures (scoliosis, abnormalities of distribution of the podalic load, abnormal head position). The extrinsic eye muscles, the head, neck and tongue muscles arise from the occipital somites: probably this explains the relationship between the ocular misalignment and abnormal posture. The objective of this work is to evaluate the relationships between oculomotor e postural defects.

Methods: N = 47 patients received a comprehensive ophthalmologic and orthoptic examination. They underwent baropodometric and stabilometric examinations.

Results: Our sample group included 37 patients with exodeviation, 17 patients with esodeviation. We observed: flat foot with an incidence rate of 83.33% (25 out of 33) in exotropic subjects; pes cavus with an incidence rate of 16.66% (5 out of 30) in exotropic subjects; flat foot with an incidence rate of 23.52% (4 out of 17) in esotropic subjects; pes cavus with an incidence rate of 76.47% (13 out of 17) in esotropic subjects. Clinical physiatry observation of patients with Eso/Exo deviations prove a considerable turn-out of postural disorders: lumbar scoliosis (76.47%).

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Conclusions: In our sample, patients with exodeviation have flat feet (83.33%); the subjects with esodeviation have pes cavus (76.47%). However, there is a widely recognized need for a further extensive study and evaluation of the results obtained regarding binocular vision and posture.

Keywords: Strabismus; esotropia; exotropia; postural dysfunction; scoliotic attitude; lumbar hyperlordosis; thoracic hyperkyphosis; hump; knee valgus; pelvis misalignment; flat feet; pes cavus; posturology; baropodometric and stabilometric examinations.

1. INTRODUCTION

The tonic postural system allows to adjust posture as a result of the constant changes in static and dynamic position. Some pathologies affecting the visual system may cause the occurrence of postural imbalances, and vice versa. Aim of this study is to evaluate the relationship between the alterations of the ocular motor system and the postural dysfunctions.

2. METHODS

A total of 47 patients underwent comprehensive ophthalmic and diagnostic examinations pre- and post-treatment. Orthoptic tests:

- Best Corrected Visual Acuity
- Ocular Motility
- Cover test (at near and at far),
- Near Point of Convergence (NPC)
- Prism Convergence,
- Stereopsis with Titmus Test

2.1 Inclusion Criteria

All patients with ocular deviation who came to the office for an ocular and orthoptic examination from January 2017 to January 2019. Their age was 7-10 years; exclusion criteria were: congenital, post-traumatic, genetically inherited musculoskeletal disorders. It is an observational study of patients who had already been examined.

All patients underwent a baropodometric and stabilometric examination.

2.2 Postural Examinations

Stabilometric analysis: performed with open eyes (OE) and closed eyes (CE), analyzing the following parameter: ellipse area, length of the ball, average speed, Romberg index.

Baropodometric analysis: static (Center of Pressure – CoP, Load in Kg) and dynamic (Center of Pressure - CoP, Load Kg).

3. RESULTS

The sample subjects (47) were structured as follows: Baropodometric and Stabilometric results related to the patients examined.

Remarks: Findings showed a prevalence of:

- FLAT FOOT with an incidence rate of 83.33% (25 out of 30) in EXOTROPIC subjects;
- PES CAVUS with an incidence rate of 16.66% (5 out of 30) in EXOTROPIC subjects;
- FLAT FOOT with an incidence rate of 23.52% (4 out of 17) in ESOTROPIC subjects;
- PES CAVUS with an incidence rate of 76.47% (13 out of 17) in ESOTROPIC subjects.

Table 1. Patients examinations

N= 30 Patients with Exotropia	N= 17 Patients with Esotropia
<ul style="list-style-type: none"> • Visus with glasses/at far: 10/10 • OM: Hyper IO OO, hyper LR OO, • CT at near without lenses EXOTR. 17.57 mean angle • CT at near with glasses EXOTR 12.23 mean angle • Stereopsis: Coarse 	<ul style="list-style-type: none"> • Visus with glasses/at far: 9/10 • OM: Hyper IO OO, hyper MR OO, AHP • CT at near/without glasses ESOTR 24.45 mean angle • CT at near/with glasses ESOTR 14.62 mean angle • Stereopsis: Absent

OM=Estrinsic Eye Movements; IO= Inferior Oblique; LR= Laterale Rectum; MR= Medial Rectum; AHP= Anomalous Head Position; CT= Cover Test

Table 2. Stabilometry squint patients

Stabilometry		
Parameters	Open eyes	Closed eyes
Surface of the ellipse	162.66 ± 0.78	740.90 ± 1.80
Length of the ball	364.4 ± 120.5	571.4 ± 102.8
Average speed	6.30 ± 2.53	12.06 ± 4.06

Table 3. Baropodometry squint patients

Baropodometry		
	CoP	Load Kg (%)
Static	154.35 ± 74.20	68.3 ± 60.7
Dynamic	120.50 ± 40.22	94.3 ± 43.9

Table 4. Postural assessment

Postural results related to 34 patients who underwent a physiatrist examination		
Postural analysis	N° of patients	%
Scoliotic attitude	26	76.47
Asymmetry of the waist triangles	16	47.05
Hump	10	29.41
Pelvic misalignment	10	29.41
Knee valgus	16	47.05
Lumbar hyperlordosis	6	17.64
Thoracic hyperkyphosis	14	41.17

4. CONCLUSIONS

Aim of this study is to encourage research on possible mechanisms of cause and effect which lead to musculoskeletal anomalies as a result of horizontal ocular deviation. These anomalies are more recurring, known and reported in cyclovertical squint.

The fact that children adopt an Anomalous Head Position to adjust and improve their visual function may result in an incorrect distribution of the body weight, which is necessary to maintain the balance. Such postural anomalies may be a concurrent cause of the skeletal diseases observed.

Findings from our sample indicate that subjects with exodeviation have flatfoot with a 83.3% incidence rate; the subjects with esodeviation have a pes cavus with an incidence rate of 76.47%.

Lions [1] highlights the importance of the proprioceptive inputs for postural control, particularly in strabismic patients. Ezane [2] underlines the use of the visuo-vestibular sensory inputs to contribute to the maintenance of upright posture to balance their altered vision due to strabismus. Bucci [3] emphasizes how

visual inputs play a relevant role in obtaining a good postural stability. Lions [3] underscores that strabismus surgery results in enhanced postural stability, as also reported by Legrand [4].

The use of proprioceptive information appears to allow a better postural stability in strabismic patients. However, such stability increases immediately after strabismus surgery and, therefore, through the reduction or the elimination of strabismus for an enhanced visual input.

Our study appears to demonstrate how the horizontal deviations modify significantly the proprioception of the support surface (exo- flat foot / eso – pes cavus) and possibly leading to “a postural strategy characterized by a reduction in physiological trunk oscillation” [5].

As argued in Nucci et al. [6], we agree that a multi-disciplinary approach should be considered for the study of abnormal head postures and also for horizontal strabismus.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline participant consent and

ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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