STATE OF CALCIUM–PHOSPHORUS METABOLISM IN COMPUTER USERS WITH COMPUTER VISION SYNDROME

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Introduction

Computer vision syndrome (CVS) is one of the leading functional disorders of the visual system among users of digital devices. Prolonged daily computer work results in visual fatigue, disturbances of accommodation, and instability of the tear film. In recent years, however, researchers have increasingly focused on systemic metabolic changes accompanying visual overstrain.

Particular interest is directed toward calcium–phosphorus metabolism, as calcium (Ca^{2+}) and phosphorus (PO_4^{3-}) are key elements ensuring normal functioning of ocular structures. Calcium is involved in nerve impulse transmission, regulation of ciliary muscle activity, and photoreceptor function, whereas phosphates are essential for energy processes (ATP), metabolic reactions in retinal cells, and maintenance of intracellular homeostasis.

Disruptions in Ca–P balance may reflect the state of neuromuscular regulation of accommodation, the degree of functional fatigue, and the adaptive–compensatory responses of the body. Despite the clear physiological importance of calcium and phosphorus in visual system function, studies of mineral metabolism in computer users remain limited, which makes this topic both relevant and timely.

Purpose of the study

The aim of the study is to assess calcium and phosphorus levels in computer users exhibiting signs of computer vision syndrome.

Materials and methods

The study population consisted of 25 computer users with clinically confirmed signs of computer vision syndrome. The control group included 25 computer users without symptoms of computer vision syndrome.

A comprehensive ophthalmological examination was performed and included the following procedures: assessment of uncorrected and corrected visual acuity, skiascopy, autorefractometry, biomicroscopy, evaluation of binocular and accommodative functions,

direct and indirect ophthalmoscopy, Schirmer's test I, as well as a biochemical blood analysis to determine total calcium and inorganic phosphorus levels.

Results and discussion:

Analysis of calcium–phosphorus metabolism parameters in computer users with computer vision syndrome and in practically healthy individuals of the control group revealed statistically significant differences between the groups for all evaluated indicators.

In patients with computer vision syndrome, the level of total calcium was lower than in the control subjects. The mean total calcium value in the CVS group was 2.24 ± 0.05 mmol/L, whereas in the control group it was 2.32 ± 0.04 mmol/L. This difference was statistically significant ($p < 0.05$), indicating a tendency toward reduced calcium levels in individuals exhibiting signs of visual overstrain.

In contrast, the level of inorganic phosphorus was elevated in computer users with CVS. The mean phosphate concentration was 1.06 ± 0.04 mmol/L, which was markedly higher than in the control group (0.95 ± 0.03 mmol/L, $p < 0.01$). This highly significant difference demonstrates a disturbance in calcium–phosphorus balance toward a relative increase in phosphate levels.

Computer users with computer vision syndrome exhibit a characteristic combination of decreased total calcium levels and increased phosphorus levels compared with healthy individuals. These statistically significant changes reflect underlying metabolic alterations associated with computer vision syndrome.

Conclusion

The decrease in calcium and the increase in phosphorus observed in computer vision syndrome reflect systemic metabolic stress, impaired neuromuscular regulation of accommodation, and increased energy demands of the visual system during prolonged computer use.

Calcium–phosphorus metabolism indicators can be considered additional markers reflecting the functional state of the visual system in computer vision syndrome.