

# Does an optometric investigation may help to prognose the neuropathy?



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**Introduction** The aim of this work was to point to some parameters which are relevant to binocular vision of diabetes mellitus patients. These parameters can be measured during an optometric investigation. In the present investigation we have measured: accommodation, phoria, vergence amplitudes and calculated the ratio characterizing dependence between accommodative convergence and accommodation. These parameters were compared to appropriate values in a control group (the healthy subjects with similar age distribution). A statistically significant difference has been found between both groups for near point of accommodation (NPA), phoria at near distance, compensating fusional vergence (CFV) and AC/A ratio (accommodative convergence/accommodation ratio). Our results show that the diabetes mellitus type 1 causes insufficiency of accommodation amplitude, enlarges risk of occurrence exophoria and limits the ability to compensate disorder of binocular vision.

**Methods** Diabetics' group consisted of 29 persons of type 1 with different course and time of disease. Control group consisted of 116 persons without pathologies in visual system. Standard optometric measurements were made in both groups. There was no statistically significant difference between age in between groups. Patients with possible presbyopia were excluded from analysis of near point accommodation (the persons were younger than 37). The measurements were made within a *push-up* method. The value of phoria was measured by applying *von Graefe's* method. The measurements of phoria and vergence amplitudes were executed using manual phoropter. The following statistical tests were applied: *t-Student*, the test *t* separate estimation of variance and non-parametric *Mann-Whitney* test (*M-W*). *Spearman's Rank Correlation Coefficient* was used to establish correlations between two sets of data. The homogeneity of variance was checked with three tests: *Fischer-Snedecor's* test, *Levene's* test and *Brown-Forsyth's* test. The normality of distribution was checked with *Shapiro-Wilk's* test.

**Results** A statistically significant difference exists between the values of NPA in diabetic's group and that control group ( $p = .04$ , *M-W*). In diabetics' group ( $N = 22$ )  $NPA = 14 \pm 2.4$  cm. In control group ( $N = 77$ )  $NPA = 9.3 \pm 1.1$  cm, see fig. 1. There was no statistically significant difference between age in both group ( $p = .38$ , *M-W*). The value of exophoria at near distance differs statistically between both groups ( $p = .018$ , *M-W*), see fig. 2. The value of exophoria  $8 \pm 1.4$  pdptr in diabetics' group ( $N = 24$ ) and  $3.9 \pm 0.6$  pdptr. in control group ( $N = 27$ ). There was no difference between the age in both groups ( $p = .64$ , *M-W*). There was no correlation between value of exophoria and time of disease ( $r = -.13$ , *Spearman's rank correlation coefficient*). The value of CFV at near distance is statistically different in both groups ( $p = .008$ , *t separate estimation of variance*), see fig. 3.  $CFV = 0.7 \pm 2.9$  pdptr. in diabetic's group and  $CFV = 8.7 \pm 1.4$  pdptr. in control group. There was no difference between the age in both groups ( $p = .30$ , *M-W*). Significant negative correlation between value of CFV and duration of disease does not exist ( $r = -.10$ , *Spearman's rank correlation coefficient*). The value of AC/A ratio is statistically different between groups ( $p = .04$ , *t-Student* test), see fig. 4. For diabetic's  $AC/A = 3.2 \pm 0.5$  and for control group  $AC/A = 4.3 \pm 0.4$ . There was no difference between the age in both groups ( $p = .90$ , *M-W*). The values of CFV was not correlated with duration of disease ( $r = -.30$ , *Spearman's rank correlation coefficient*).

**Conclusions** Disorders in binocular vision in diabetic patients are observed more often than in case of healthy persons. The diabetes mellitus type 1 limits significantly the accommodation amplitude. Exophoria at near distance is significantly bigger in diabetic group and compensating fusional vergence and values of AC/A ratio are statistically smaller. Although value of amplitudes at far distance is not statistically different, one can observe a tendency for limiting this parameter. The above results and literature may be basis to statement that the functioning of diabetic's important nervous pathway is burdened. Especially this may concern the third pair of cranial nerves. This state is similar to insufficiency of important organs in diabetic patients, which may be related to angiopathy and neuropathy.

**The optometric measurement of binocular vision may be used to prognose and monitor a possible neuropathic changes since some signs of disorder may be detected before clear symptoms and dysfunctions of visual system appear.**

Figure 1.

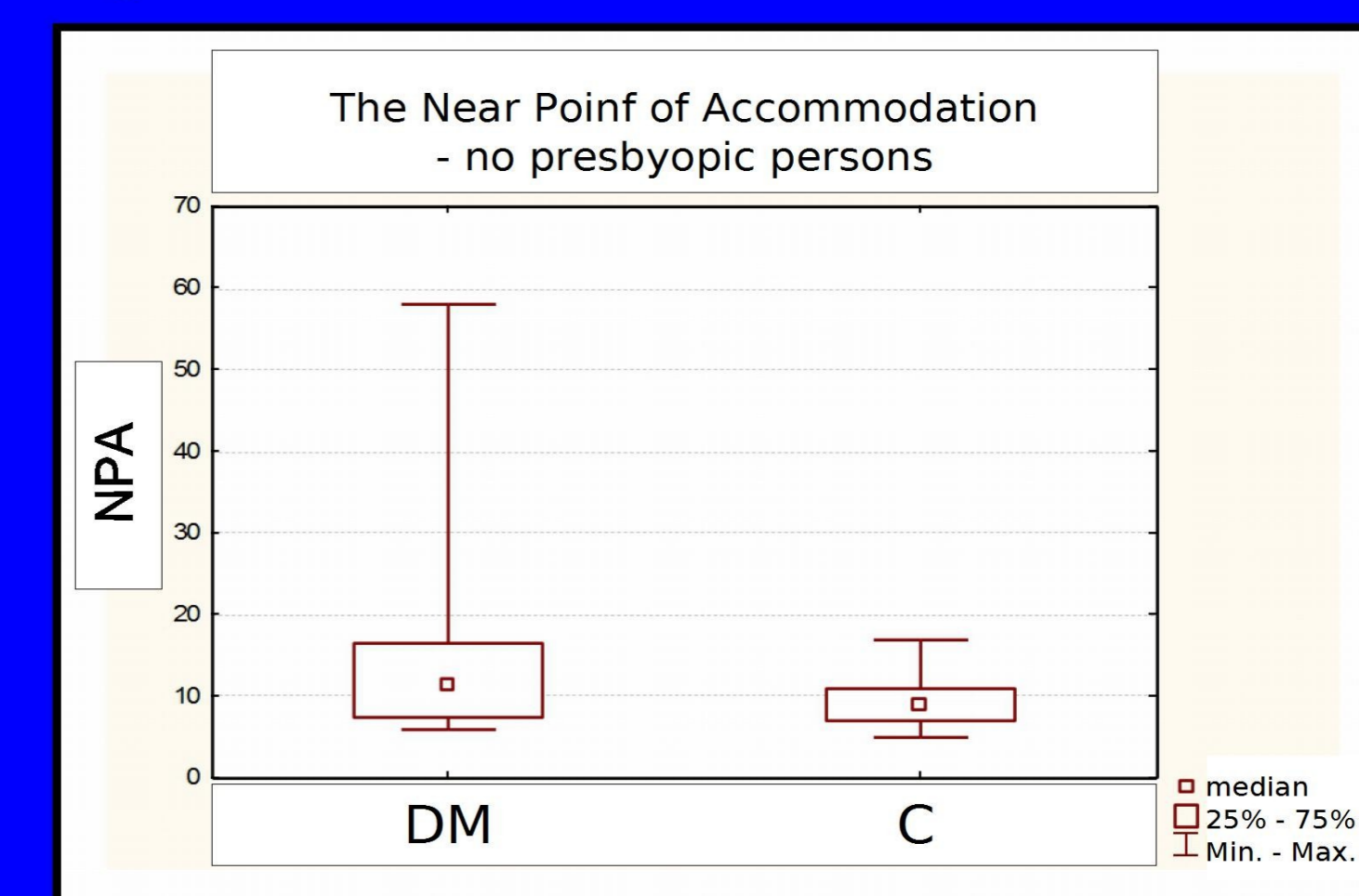


Figure 2.

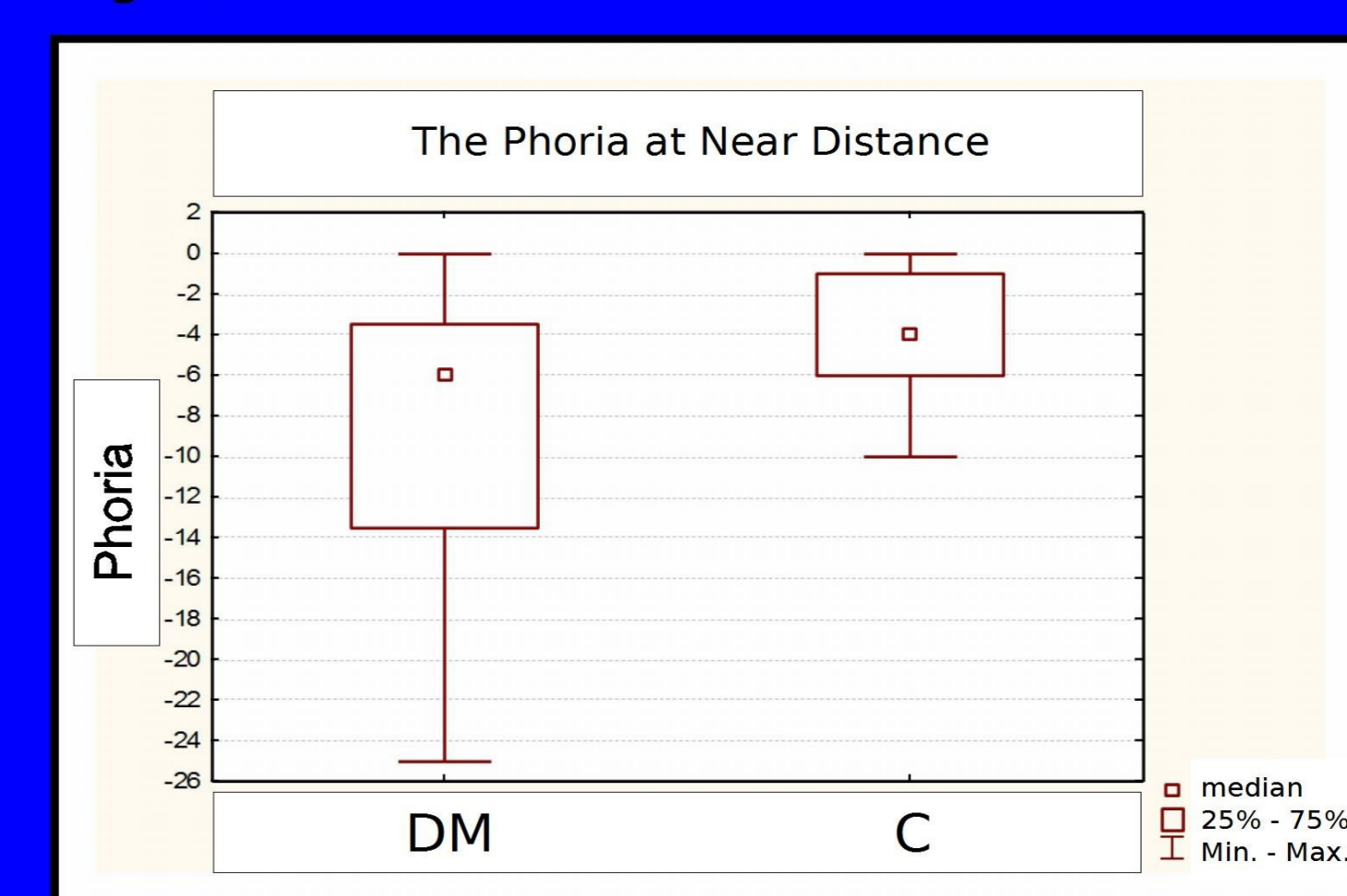


Figure 3.

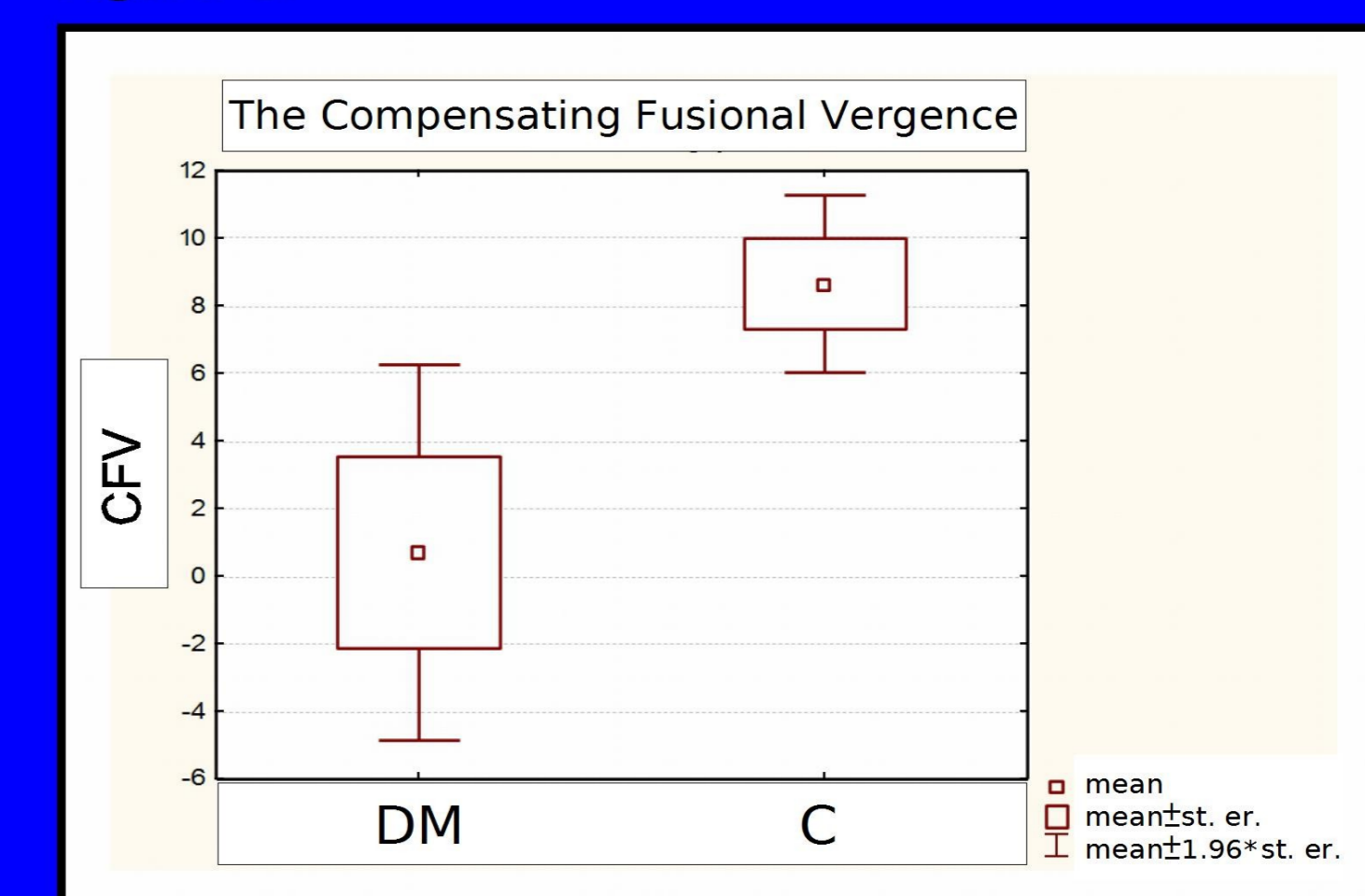
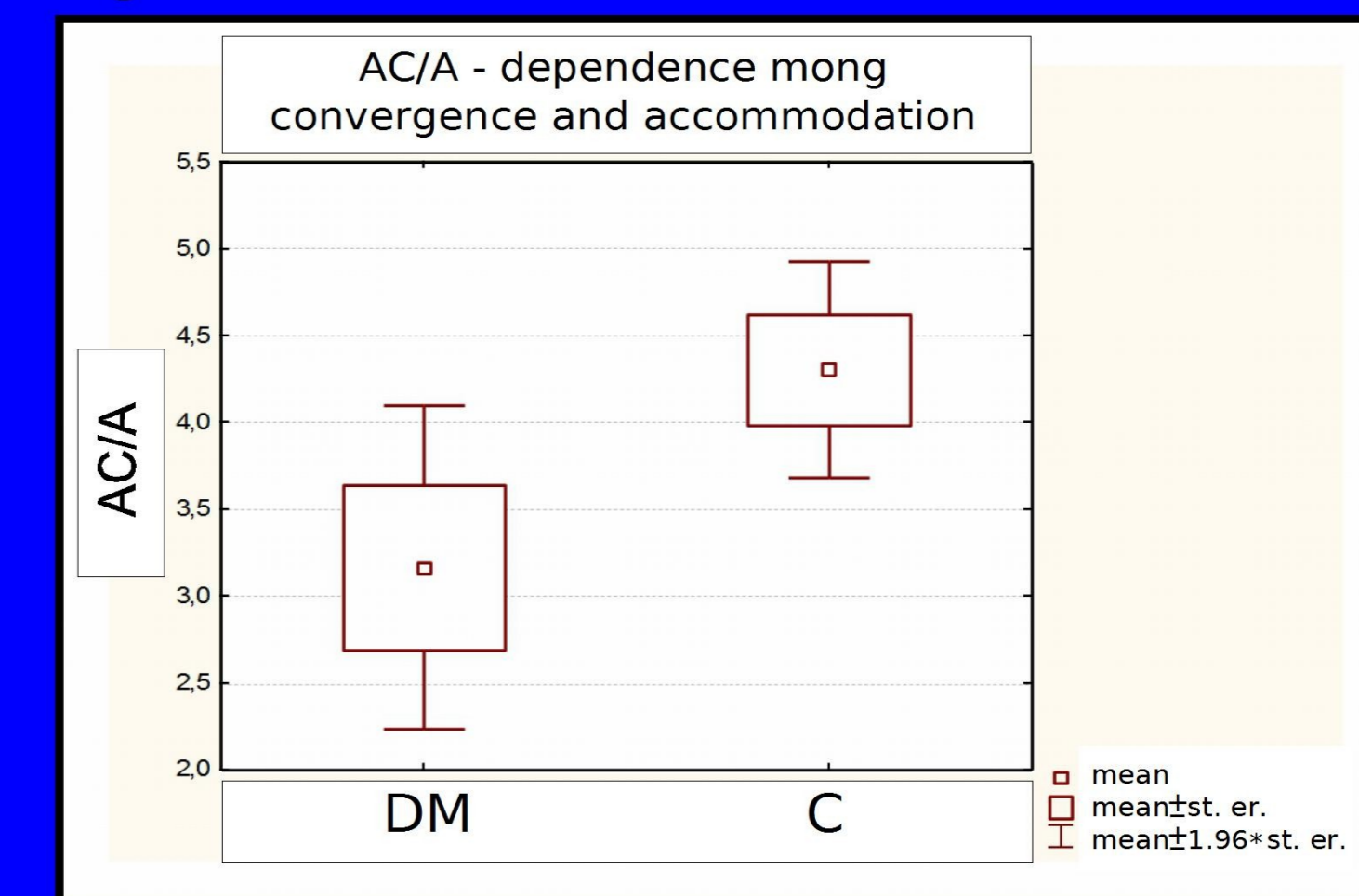


Figure 4.



DM - diabetic group

C - control group

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