Enhancing balance with visual training, a study on elderly

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Introduction

Postural control, in particularly balance requires the integration of multisensory inputs such as: visual, vestibular, somatosensory and proprioceptive (Redfern et al., 2001; Sundermier et al., 1996). Even the single contribution of these inputs are clear, specific influences of vision was available only for open and closed eyes (Owen et al., 1998), neurological patients with hemianopia (Paysse, Coats, 1997) or unilateral spatial neglect (Van Nes et al., 2009). Compared to these patients, no specific functional visual factor in healthy subjects where found. Neither evidence if the improvement of visual skills results in better balance was also available.

Aims

The questions that this study tries to answer are:

1) What is the relationship between visual and balance measures on a group of elderly?
2) Are there an improvement of balance after a visual training program?

Subjects

Thirty healthy subjects from 57 to 82 years old participated in the study. They were subdivided in two groups, the first (experimental) performed a visual training program and were compared to the second (control) which were only tested two times and were considered as a control group.
The first experimental group comprises 18 subjects.
The second control group comprises 13 subjects.

Procedure

Before treatment were performed an optometric and balance examination, after treatment were performed only balance examination:

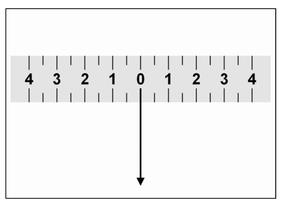
Optometric part:

Ocular dominance

Visual acuity

Stereopsys

Far phoria



Nsuco Saccades

Balance part:

Standard and modified Tandem Walking test

Tinetti balance scale

Stability on balance board with open and closed eyes

Visual training

Only the experimental group performed a total of 24 session of Visual Training, 3 each week for 8 weeks.
Visual training program was focused primarily on ocular movements. During sessions there were performed 11 different exercises for saccades and pursuits with different targets and Marsden ball, with three difficulty levels for balance:

1) Feet away
2) Feet close
3) Right foot in front of the left.

Results

1) A correlation analysis between visual and balance skill shows:

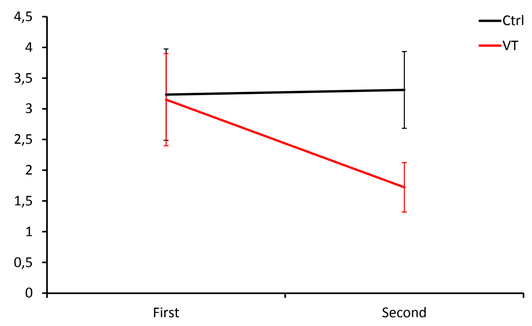
A medium and significant relationship between stereopsis (logarithmic transformation) and Tinetti balance test: with better stereopsis (lower angle) correspond higher results on Tinetti test (better balance)

Stereopsys ← **r = -0,49 p<0,01** → **Tinetti balance test**

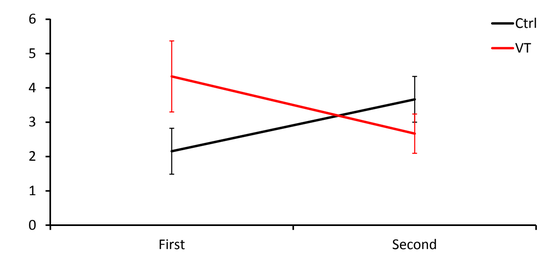
A medium and significant relationship between stereopsis (logarithmic transformation) and time needed to gain first balance for 10s on balance board. Better stereopsis correspond to lower time needed to gain balance on a balance board.

Stereopsys ← **r = 0,42 p<0,05** → **Balance board**

2) After visual training there are a significant improvement only for VT group:



On Tandem Walking test an ANOVA with the factors Session and Group show a significant results for the interaction of the two factors ($F_{(1,29)}$=3.75 p<0.05). Only the group who performed VT show a reduction of errors.



The stability on a balance board with eyes open (errors performed during counting 1- 10 - 1) show with the same analysis a significant results for the interaction ($F_{(1,29)}$=5,66 p<0.001)

Conclusion

Firstly, we found a significant relationship between balance control and one visual skill: the stereopsis. Better stereopsis correspond to better balance.

Secondly, after visual training only VT group showed specific improvement, in walking and in a balance board test. These results support the role of specific visual skill on a control of balance and show the indirect efficacy of visual training on balance control

References

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