Sir,

The Relationship Between Stereopsis and Fine Manual Dexterity: Pilot Study of a New Instrument

Although good stereoscopic vision and a high degree of fine manual dexterity are thought to be pre-requisites for ophthalmologists, there is no requirement for formal assessment of either, in doctors contemplating a career in ophthalmology. By measuring those attributes, it should be possible to identify doctors who could have problems with the practical aspects of the specialty. Counselling could then be given before an inappropriate career is embarked upon. Stereopsis is easily measured by orthoptic tests.[1] Although there are several recognised dexterity tests,[2] none adequately assess the type of skills required by a microsurgeon or, for the purpose of our study, have good three-dimensional visual clues.

We have devised a novel dexterity test which overcomes these problems. In our study, this test has been used to determine the relationship between the level of stereopsis and fine manual dexterity in four groups of people.

Group 1 comprised 18 post-fellowship ophthalmologists (a profession thought to require a high degree of fine manual dexterity), all with normal stereoacuity (60 seconds of arc or better). Group 2 consisted of 44 subjects with normal stereoacuity. Group 3 had 10 subjects with reduced stereoacuity (stereoacuity measured at 120 seconds of arc or poorer). Group 4 consisted of 17 individuals with no demonstrable stereopsis. All persons in Groups 2, 3 and 4 had some form of higher education, were between ages 20 and 45 years and had no physical disability. Stereopsis was evaluated using both TNO and Randot tests.

Our dexterity test consisted of a metallic loop and a test wire, both connected by an electrical circuit to an electronic counter and light bulb (Fig 1). The test wire was curved in three continuous bends, each with a radius of curvature of approximately 6 millimetres and tilted at a 45° angle, so that 3-dimensional visual clues were required to perform the test. The aim of the test was to pass the hand held loop from one end of the wire to the other, avoiding contact between the loop and wire. Each time the loop and wire touched, the counter registered a score of one. Should the loop continuously touch the wire as it was moved, the light bulb incorporated into the circuit came on, indicating this continuous contact.

Each person was given an explanation and demonstration of the test, following which three minutes were allocated for practice. The test was performed five times and the lowest number of touches (score) per attempt was recorded. If continuous contact was noted the person was given a score of fifty points for that attempt.

The mean lowest score for each group was calculated (Table I). Results for each group were compared statistically using the T-test.

When Group 1 (ophthalmologists with normal stereoacuity) was compared to Group 2 (normal stereoacuity), Group 1 had significantly lower scores ($P = 0.0002$. Group 2 compared to Group 3 (reduced stereoacuity) demonstrated, no statistically significant difference ($P = 0.23$). However, when Group 2 was compared to Group 4 (no stereopsis) the subjects in group 2 achieved significantly better scores ($P < 0.0000001$).

Comment

Ophthalmologists performed this dexterity test better than all of the other groups studied ($P = 0.0002$). This test therefore measures a manual dexterity skill possessed to a high degree by ophthalmologists, which suggests that the test may be a useful method of assessing some of the skills required by ophthalmic surgeons.

Although there was no significant difference in the scores of the group with normal stereoacuity and that with reduced stereoacuity, there was a much wider range of scores within the group with reduced stereoacuity. There was no linear relationship between the level of stereoacuity and the dexterity test score. Some subjects with relatively poor stereoacuity could perform the test reasonably well. Our study suggests that only relatively crude stereoscopic vision is required to perform fine motor tasks with 3-dimensional visual clues.

Table I *(Results)*

Group	*Subjects*	*Mean Lowest Score*	*Range*	*S.D.*	*S.E.M.*
1	18	2.72	0–8	3.20	0.75
2	44	6.75	0–16	4.37	0.66
3	10	12.40	3–50	13.90	4.20
4	17	40.80	11–50	15.40	3.70

the mean lowest scores for each group performing the 'wire-loop' dexterity test are illustrated.
GROUP 1 = Ophthalmologists with normal stereoacuity.
GROUP 2 = Normal stereoacuity.
GROUP 3 = Reduced stereoacuity.
GROUP 4 = No stereopsis.
S.D. = Standard deviation
S.E.M. = Standard error of mean.

The majority of the 17 subjects with no stereopsis were unable to perform the test. However, there were two notable exceptions- a consultant vascular surgeon with a microtropia and a male staff nurse with unilateral congenital glaucoma who practised target shooting. Although these individuals could perform the test, their scores were below average when compared to persons with normal stereoacuity.

On the basis of our results, it seems reasonable to conclude that in general, people with no stereopsis do have difficulty performing tasks with 3 dimensional visual clues. However, it is noted that there are individuals who have better manual dexterity than one might anticipate on the basis of stereoacuity testing alone. We therefore suggest that a combination of stereoacuity assessment and dexterity testing using the wire-loop test could provide a good basis for counselling junior doctors wishing to embark on a career in ophthalmology.

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