Comparison of the binocular stereoacuity measured by the *TNO stereotest* vs the *Frisby Stereotest Near FSN* in healthy adult subjects
A prospective, monocentric, non controlled, non randomised and open study

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AIMS

In **healthy adult** subjects,

1) To **compare** the binocular stereo acuity measured by the *TNO Stereotest* vs the *Frisby Stereotest Near FSN,*

2) To test the **TNO sensitivity** to the subject's positioning.

PROTOCOL

Visually normal adults passing their hiring Air Crew vision screening assessments **underwent three stereo acuity measurements** with both TNO and FSN tests :

1) **TNO** test **without strict control** of the subject positioning

2) **TNO** test **with strict control** of the subject positioning

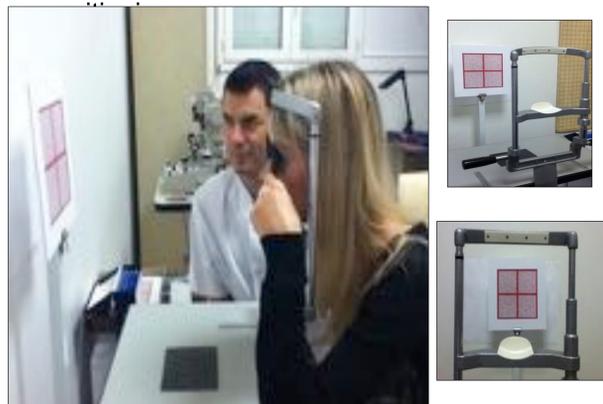3) **FSN** test **with strict control** of the subject positioning

MATERIALS

1) **TNO** test **without strict control** of the subject positioning :

(On the pictures : *Laure VEYSSIERE & Joaquim TESSON*, CO of the Hôpital d'Instruction des Armées; CPEMPN Clamart)

2) **TNO** test **with strict control** of the subject positioning :

3) **FSN** test **with strict control** of the subject positioning :

DISCLOSURE

The authors, have disclosed no relevant financial relationships

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The subject underwent three stereo acuity measurements in a room set up **with two dedicated workspaces** :
1.A desk for TNO testing without strict control
2.A chin rest, oriented toward a the test support. The chin rest distance to the test support is adjusted through a shifting along floor marks. This workspace is dedicated to the TNO and FNS measurements with strict control of the subject's positioning.

The room is a bright space with only diffuse ceiling lights (no natural light), and without shadowing.

METHODS

A detailed ophthalmologic and a refractive examination is systematically performed (*Tropicamide* cycloplegia).

Distance of presentation :

1)TNO1 : without strict control of the subject's positioning
The examiner hold the plates approximately at a distance of 40cm, squarely in front of the subject. The subject is **allowed to move gently and slowly** his head.

2) TNO 2 : with strict control of the subject's positioning
The subject's head is firmly supported by the chin rest at a precise distance of 40cm of the plate. **He is not allowed to move** his head.

3) FSN : installed in the chin rest, the subject is assessed at two presentation distances :
① **67cm :** for the 120" (6mm plate), 60" (3mm plate) and 30" (1,5mm) levels
② **95cm :** for the 15" (1,5mm) level

Precautions :
Since the TNO test is assessed twice and in order to avoid any learning bias :
✓the passing order of the TNO measurements is **randomly chosen**. The FNS testing is always assessed between the two TNO.
✓Between the two TNO testings, the plates are presented upside down. As a result, the red-green spectacles is reversed too, to ensure to keep a same depth direction.

Inclusion Criterion :

•Adults,
 18 and 40y,
•Without any visual disease,
•Without dyschromatopsia,

Minimum Visual Acuity Required		Tolerated Amétropia	
Without correction	With correction	Myopic	Hyper-metropic
9/10 (20/22) for each eye	10/10 (20/20)	–0, 50	+1, 50
8/10 (20/25) for each eye or 9/10 (20/22) & 7/10 (20/29) or 10/10 (20/20) & 6/10 (20/33)	10/10 (20/20) for each eye	–1, 0	+2, 0

Primary Assessment Criterion :
For both TNO and FSN, the subject is asked to recognize successively **two figures per stereo disparity level**.
Four disparity levels have been assessed, in decreasing acuity order : 120", 60", 30" & 15".
For each level, two tests items have been presented. If no one, or only one figure is recognized, or if the subject makes a wrong answer (and even if he corrects it), the testing is stopped.
The qualitative variable retained is the lowest disparity recognized for each of the three tests.
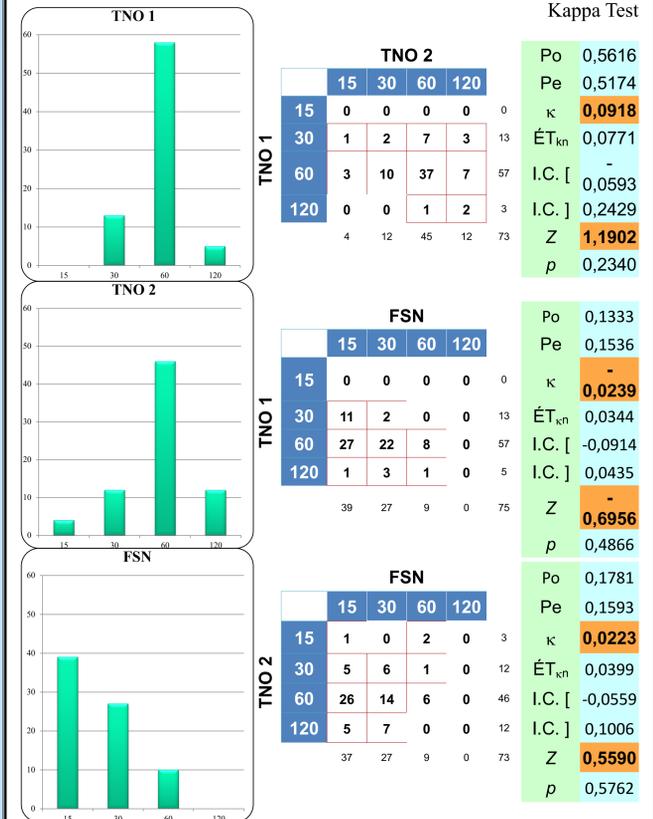
Secondary Assessment Criterion :
The qualitative variable retained is the lower disparity recognized for the two testings.

RESULTS

90 adults aged between 20 to 38 years old [Mean (SD) : 25 y (4,4)] were recruited between Sept 2011 and Oct 2011.
13 subjects (14,4%) were excluded from the analysis (6 because of an over range ametropy, 3 for microstrabisms, 4 for protocol non respect). Therefore, **77 subjects (85,6%) were included** in the final analysis.

TNO 1 vs TNO 2

	TNO 2				
	15	30	60	120	
15	0	0	0	0	0
30	1	2	7	3	13
60	3	10	37	7	57
120	0	0	1	2	3
	4	12	45	12	73

Kappa Test
Po	0,5616
Pe	0,5174
κ	0,0918
ÉT$_{kn}$	0,0771
I.C. [	–0,0593
I.C.]	0,2429
Z	1,1902
p	0,2340

TNO 1 vs FSN

	FSN				
	15	30	60	120	
15	0	0	0	0	0
30	11	2	0	0	13
60	27	22	8	0	57
120	1	3	1	0	5
	39	27	9	0	75

Po	0,1333
Pe	0,1536
κ	–0,0239
ÉT$_{Kn}$	0,0344
I.C. [	–0,0914
I.C.]	0,0435
Z	–0,6956
p	0,4866

TNO 2 vs FSN

	FSN				
	15	30	60	120	
15	1	0	2	0	3
30	5	6	1	0	12
60	26	14	6	0	46
120	5	7	0	0	73
	37	27	9	0	73

Po	0,1781
Pe	0,1593
κ	0,0223
ÉT$_{Kn}$	0,0399
I.C. [	–0,0559
I.C.]	0,1006
Z	0,5590
p	0,5762

1.No statistically significant agreement were found between the TNO and FSM stereo acuity measurements (*p*=0,4866 & *p*=0,5762)
2.No statistically significant agreement were found between the two different ways to achieve the TNO measurement (*p*=0,2340).

CONCLUSIONS

The normal stereo acuity obtained in normal subjects by the TNO (whichever way we used it) is centered on a mean value of 60" (seconds of arc) while a mean value of 15" for the FSN.
Both tests succeed to provide an evidence of stereo acuity of the 77 subjects but the **lack of reference test** has prevented from meaningful conclusions to be drawn on the correct level of stereo acuity to be retained.
Regarding the TNO sensitivity to the subject positioning, the lack of statistical agreement could be explained by the high variability of the measurements and the low number of observations. An another study should be conducted to confirm the relative non sensitivity of the TNO to the presentation conditions.

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