

Visual acuity charts: comparison study



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Background and aim

Introduction

In clinical practice, visual acuity charts are used mainly for optical correction prescribing and detecting of severe impairments. Most of the charts known are good enough for these tasks.

But if you want to assess treatment results, to monitor subtle changes, to track age dynamics or to conduct precise scientific experiments, you need the chart, that 1) is precise, 2) provides repeatable and reliable results.

The aim of the study was to assess repeatability of *Lea-screener* chart and new visual acuity charts: with wide-space design (*IITP*) and with proportional design (*IITP-V*).

Methods

Procedure

Best corrected visual acuity was assessed twice (test and retest) with three test charts in random order, monocularly and binocularly, at viewing distance 4 m. Ambient light corresponded to 250 lx, luminance of charts – to 160 Cd/m².

Subjects

	Average visual acuity:		
	I group	Optic nerve atrophy and retinopathy	15 subj.
42 subjects (11.1±0.2 yrs)		0.1 (1.0 logMAR)	
	II group	Light amblyopia	27 subj.
		0.9 (0.05 logMAR)	

Results

We compared test and retest data by Wilcoxon signed-rank test. In group 1, the results of test and retest were significantly different for Lea chart ($p=0.003$), that indicates poor repeatability; for IITP and IITP-V charts no significant differences were found ($p=0.611$ and $p=0.807$). In group 2, no significant differences were found for all three charts ($p=0.727$ - Lea, $p=0.340$ - IITP, $p=0.974$ - IITP-V).

Thus, according to our data, in group with worse visual acuity (with optic nerve atrophy and retinopathy), Lea-screener chart show worse repeatability than IITP and IITP-V chart. In group with better visual acuity (light amblyopia), all charts provided comparable results.

Bland-Altman plots, designed to compare test and retest measurements (agreement between two measurements for each chart separately) shows better results for IITP-V chart.

Results: p-values for comparison test and retest

	Lea	IITP	IITP-V
Optical nerve atrophy and retinopathy I group	$p=0.003^{**}$	$p=0.611$	$p=0.807$
Amblyopia II group	$p=0.727$	$p=0.340$	$p=0.974$

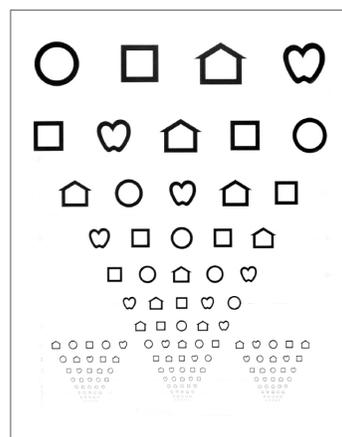
Conclusions

For precise and repeatable visual acuity assessment in children with optical nerve atrophy and retinopathy (bad visual acuity), Lea chart seems to be inappropriate because of bad repeatability.

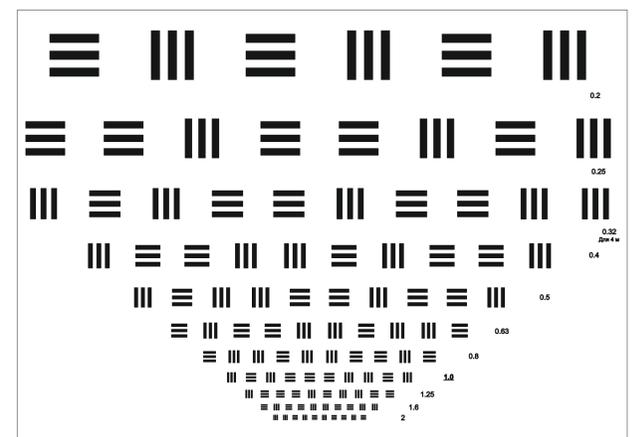
IITP charts might be better alternative for repeatable testing in medical practice.

References
1. Rozhkova G, Lebedev DS, Gracheva M, Rychkova S. Optimal optotype structure for monitoring visual acuity. Proc Latv Acad Sci Sect B Nat Exact, Appl Sci. 2017;71(5):327-338. doi:10.1515/prolas-2017-0057
2. Lebedev, D. S., Belozherov, A. E., Rozhkova, G. I. (2010). The optotypes for an accurate assessment of visual acuity [Оптотипы для точной оценки остроты зрения]. Patent 2447826; 07.12.10 (in Russian).

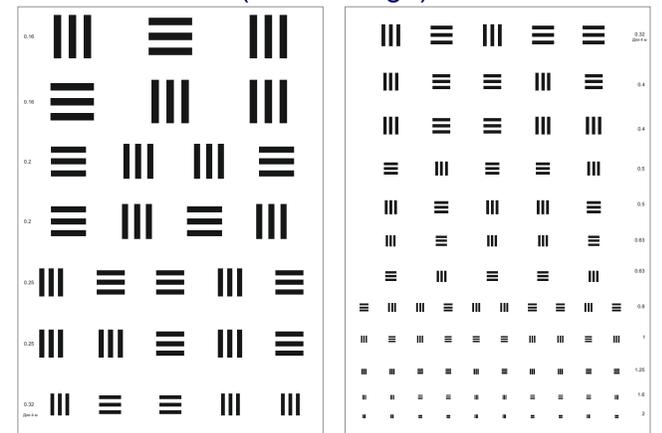
LEA chart



IITP-V chart (proportional design)



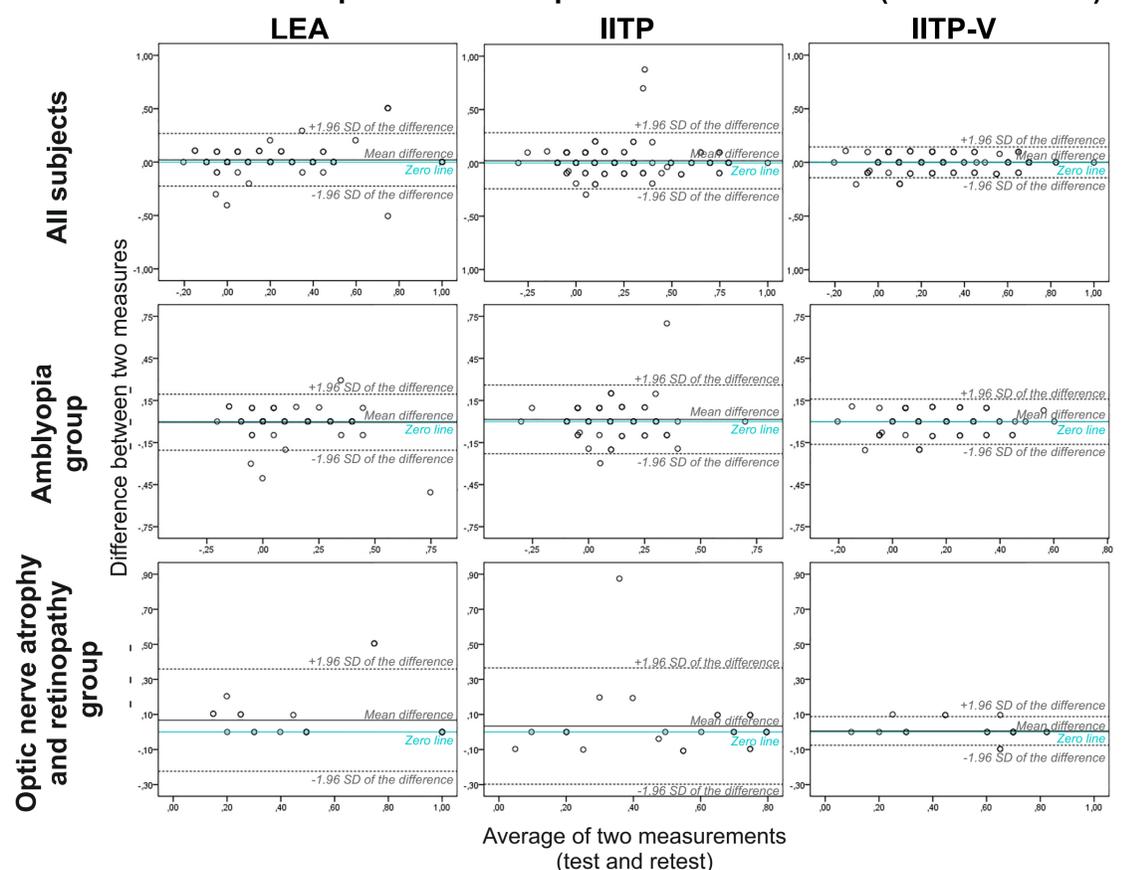
IITP chart (linear design)



Modified 3-bar optotypes

IITP charts contains modified 3-bar optotypes which were shown to have better repeatability in comparison with tumbling-E [1, 2].

Bland-Altman plots for two repeated measurements (test and retest)



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