

Comparison of the Rebound tonometer (Icare[®] TA01) to the Goldmann Applanation Tonometer*

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*extract from the manuscript, authors A.Kontiola, E.Vesti.

Materials and methods

The study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. The local Ethics Committee permitted the study. The study group consisted of 114 volunteers in the Helsinki University Eye hospital. Most of the patients were suspected of having glaucoma. There were 66 females and 48 males. Median age was 64 years (range 25-88 years).

The calibrations of the Goldmann tonometers (Haag Streit AT900 and H03) were checked before the study according to manufacturer instructions. IOP was measured with Goldmann tonometer twice with two different persons blindly. The Goldmann tonometer measurements were performed in different rooms, different persons and different tonometers. The time intervals of the Goldmann measurements were less than 30 minutes. Total of 10 different people performed the Goldmann tonometer measurements. The rebound tonometer used was the prototype (to be commercial device) of Tiolat TA01 Icare[®] tonometer. It has 26.5 mg probe with a round plastic tip (radius 0.9 mm).

The probe is moved using a magnetic field and the speed is 0.25-0.35 m/s at the time of impact to the eye. The measurement is microprocessor controlled so the measurement is interrupted if the probe does not hit the object inside the 10mm distance. The tonometer measures motion parameters of the probe indirectly by measuring the magnetic field, which is caused by the moving probe.

The TA01 was calibrated separately by measuring 25 persons (49 eyes) with Goldmann tonometer and adjusting the calibration table in software accordingly. Rebound tonometer measurement was done by three person (A, B, C), two nurses and a physician. Person A measured 30 patients, B measured 35 patients and C measured 49 patients.

Statistical analyses were performed using SPSS[®] for Windows, Ver. 11.0, software (SPSS, Chicago, IL, U.S.A). Pearson's and Spearman's correlation coefficient were calculated. Paired samples t-test was used in analysis of difference in IOP. Bland-Altman test was also used to evaluate the difference in the IOP readings [1]. Normality was tested using Kolmogorov-Smirnov test.

Results

The mean IOP reading was 18.3 mmHg SD 6.25 mmHg for Rebound tonometer and 17.9 mmHg SD 5.7mmHg for the mean of Goldmann tonometer readings. The IOP (Goldmann and rebound tonometer) values were not normally distributed ($p < 0.05$). The correlation constants between the mean Goldmann tonometer readings and Rebound tonometer was 0.83 (Spearman) and 0.87 (Pearson) for the right eye. For the left eye the correlation constants were 0.82 (Spearman) and 0.90 (Pearson). In the paired samples t-test the mean difference between Rebound tonometer and mean of Goldmann measurements was -0.71 mmHg SD 2.96 mmHg ($p < 0.05$) for the right eye and -0.27mmHg SD 2.84 mmHg ($p = ns.$) for the left eye. Of all the IOP readings 55% were between ± 2 mmHg and 75% were between ± 3 mmHg from the mean of Goldmann tonometer readings.

In the Bland Altman test 96% of the values were within ± 2 SD and there were

not any significant bias between the mean of Goldmann tonometer readings and Rebound tonometer readings.

The correlation constant between the two Goldmann tonometer measurements was 0.92 (Spearman) and 0.93 (Pearson). In paired samples t-test the mean difference was -0,1mmHg SD 2,1 mmHg (p=ns).

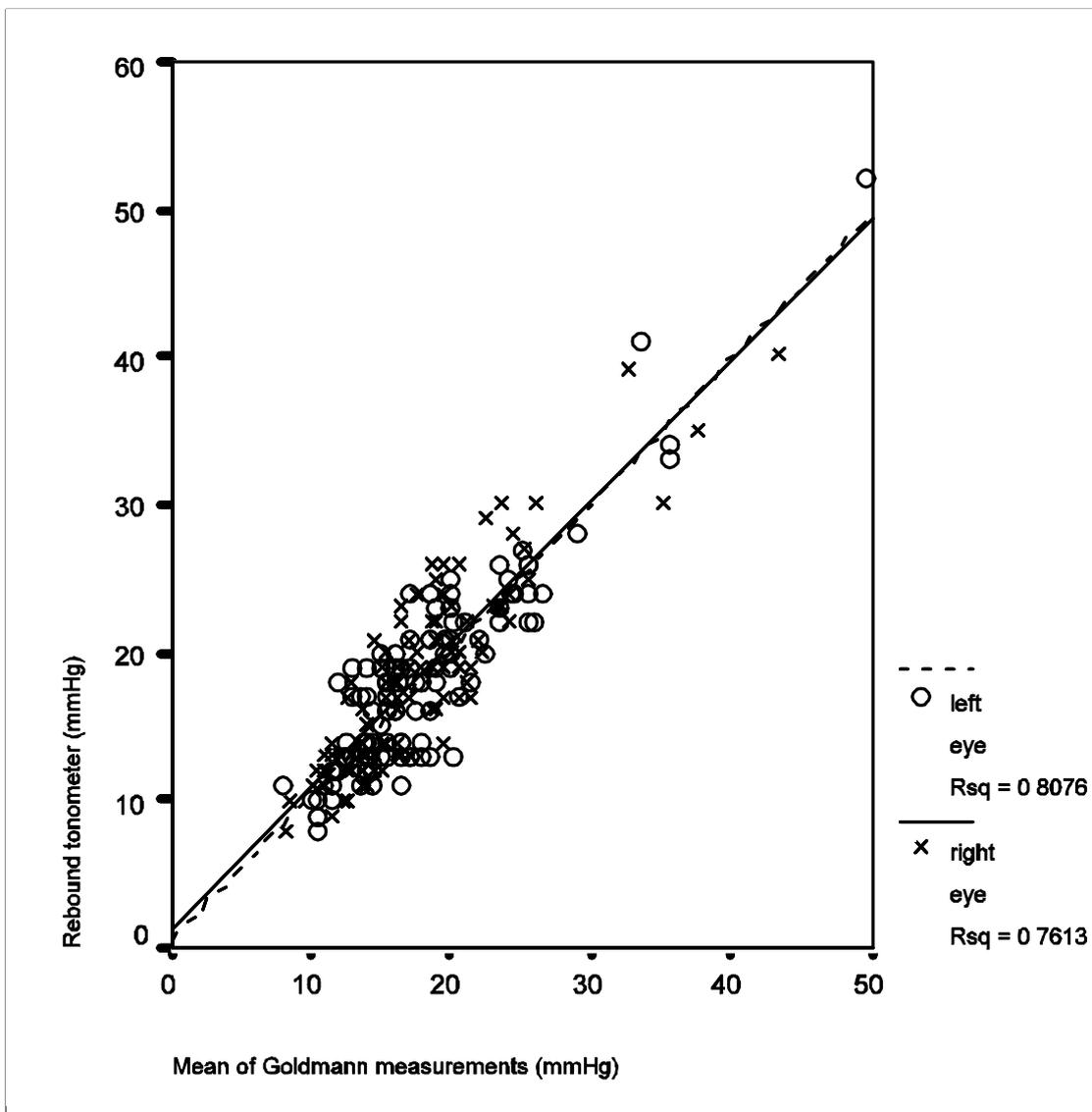


Fig. 1. Scatterplot of the IOP measurements

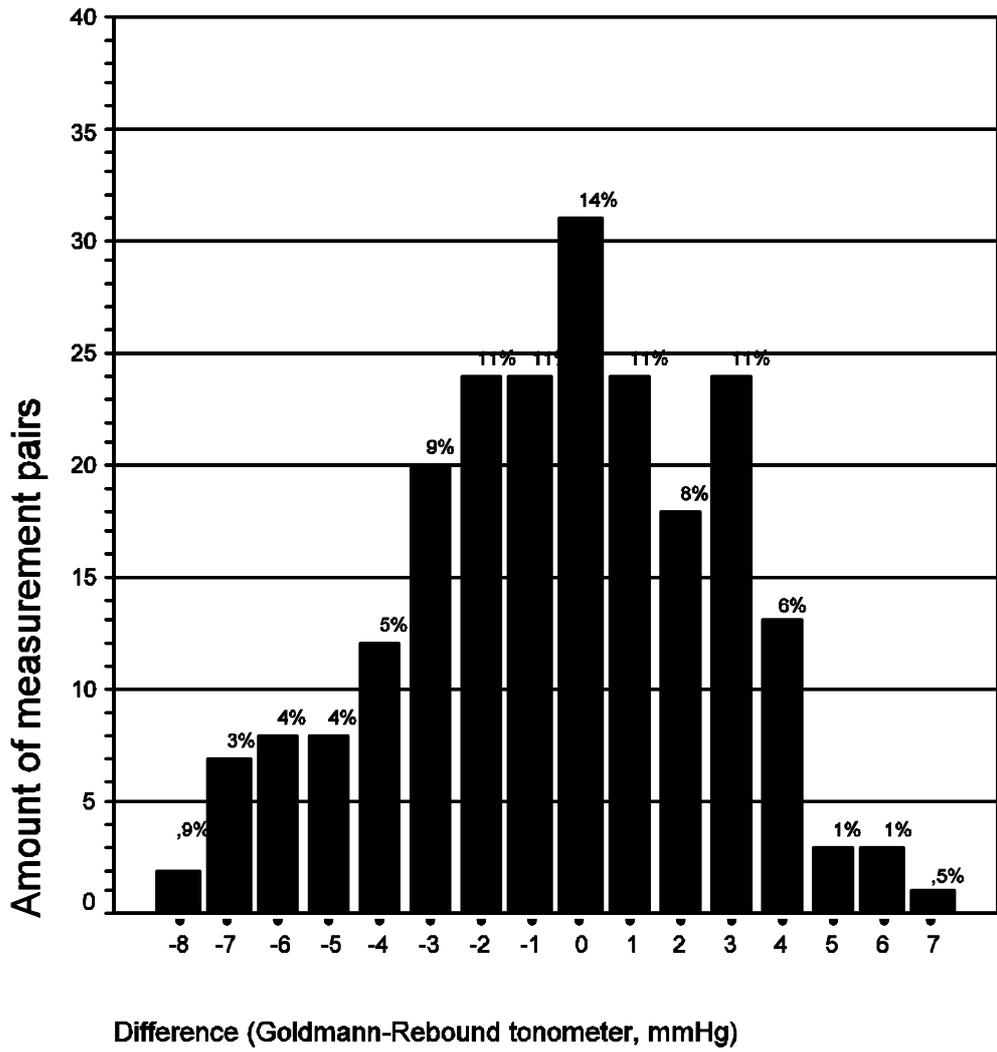


Fig 2. Bar graph of the difference in IOP readings

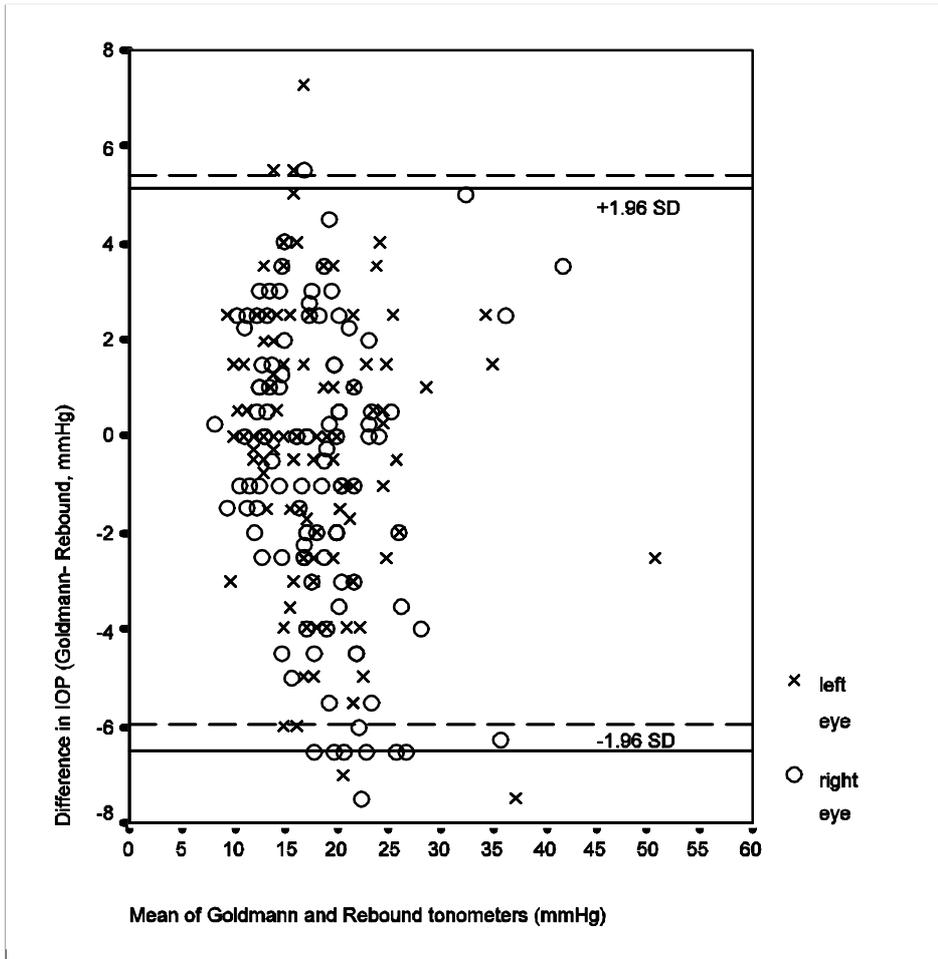


Figure 3. Bland Altman analysis