# EMERGENCY MEDICINE UPDATE:

TONOMETER DIATON® **SELECTED FOR**
**EMERGENCY DEPARTMENT (ED) / EMERGENCY ROOM (ER)**

## INTRAOCULAR PRESSURE (IOP) MEASUREMENT WITH DIATON® PEN TONOMETER


**INTRODUCTION:**

DIATON® Tonometer Pen ( BiCOM Inc, USA) is Non-corneal, Non-contact, Transpalpebral (through eyelid) handheld tonometer.

DIATON® PEN TONOMETER is a handheld, pen-shaped device used for measuring intraocular pressures (IOP). The DIATON Pen tonometer calculates pressure by measuring the response of a free-falling floater, as it rebounds against the tarsal plate of the eyelid and the sclera.

The patient is positioned so that the tip of the device and lid are overlying sclera, in either sitting or supine position.

Non-corneal and transpalpebral tonometry does not involve contact with the cornea and does not require topical anesthetic during routine use. Contact lenses do not need to be taken out and central corneal thickness (CCT) and other corneal properties do not influence the IOP measurement.

In Emergency Department and Acute Care settings IOP measurement is indicated in cases of acute eye injury, acute eye pain, red eye, and acute loss of visual acuity. Normal intraocular pressure ranges between 10-20 mmHg.

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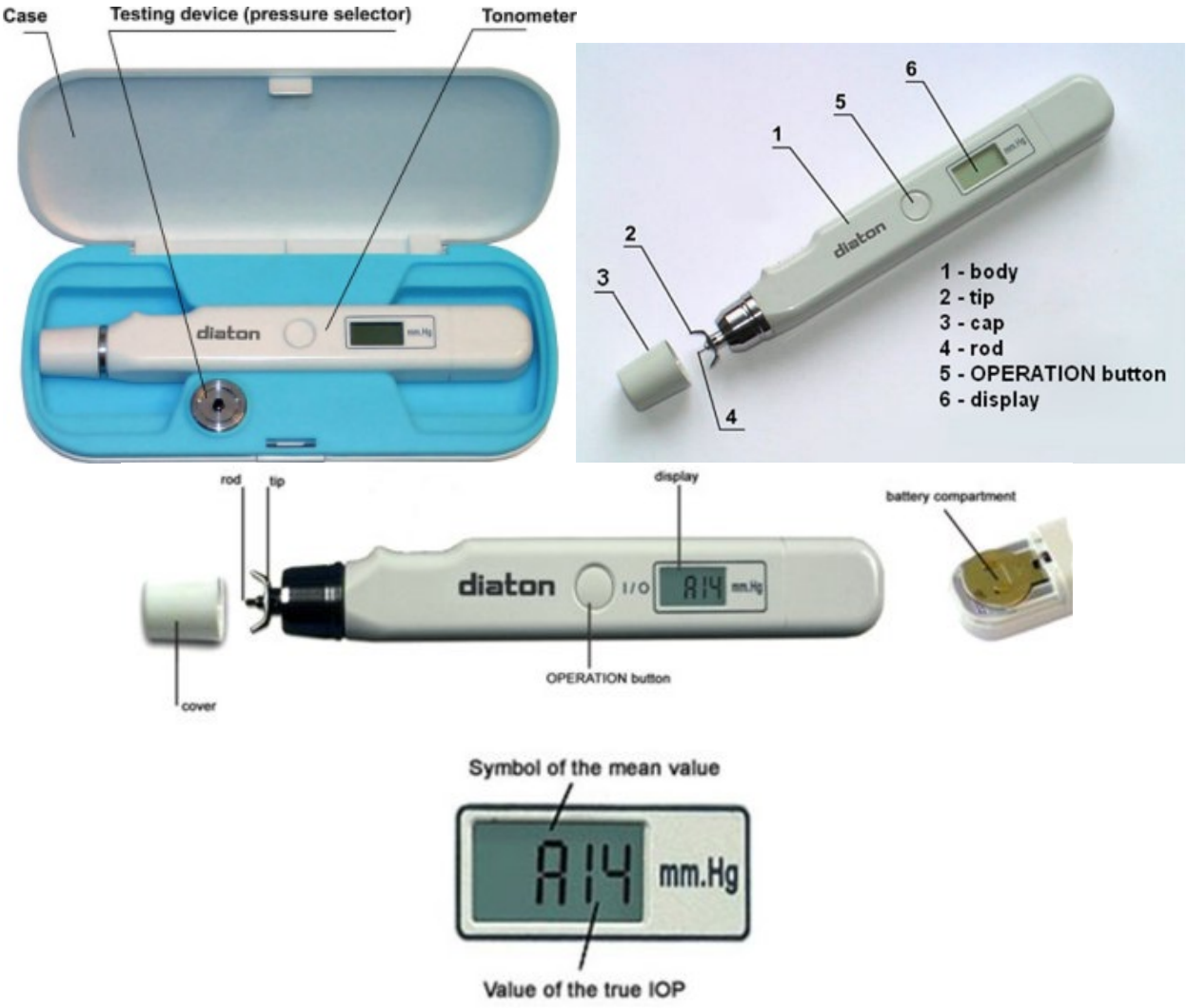
**EQUIPMENT, SUPPLIES & MAINTENANCE:**




To measure intraocular pressure with a DIATON® Tonometer Pen, the following equipment is needed: a pen tonometer, alcohol swab – to wipe off the tip of the tonometer between patients.

NO need for topical anesthetic (either properacaine or tetracaine) or tip covers since the measurement is taken over upper eyelid.

DIATON® Tonometer Pens are battery operated devices.
Tonometer will indicate “U” on the display if the battery is low. Batteries are button CR2032.

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The parts of the tonometer are: the stainless steel tip, the operation button, and an LCD display. The operation button is used for turning the device ON and OFF and to obtain AVERAGE aget measurements.
The LCD screen provides information about the sequence of readings, possible errors and tells you the pressure reading.

**CALIBRATION:**
DIATON® Tonometer Pen comes with a carry case which includes Pressure Selector Testing Device. To check for calibration, simply take the measurement on the Testing Plate. Results should be within ±2mm of 20mm. LCD display will also indicate any other errors or if the device needs to be cleaned.
Frequency of testing – once a day.


**MEASURING IOP**:
The patient should be relaxed and seated at the edge of the chair and reclining back, with head titled back as horizontal as possible or lying down flat prior to beginning. Tight shirt collars should be loosened. Patient should extend a thumb forward at appx 45º to center the eye. User should guide the patients to be in the correct position.

**Putting the rod into working position**

**The working position of the rod is its fixed inside the device** (the rod is not seen in the tip area).

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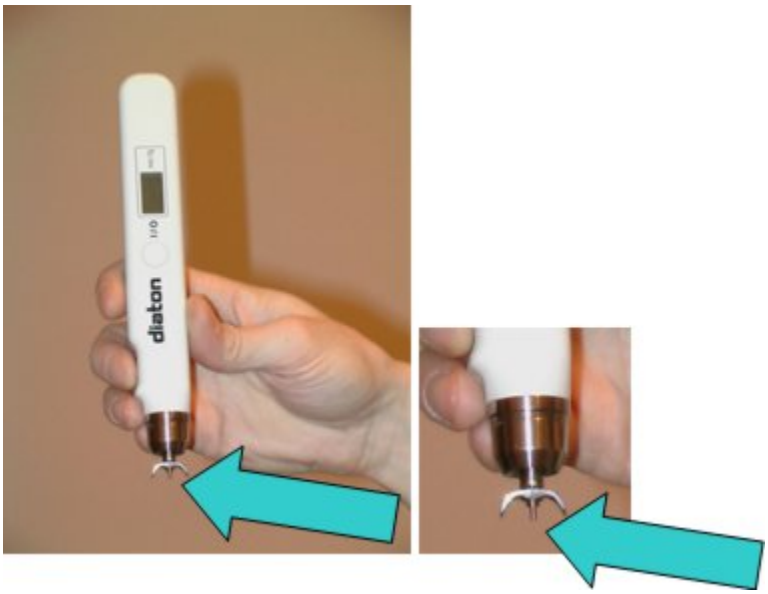


Fig. 1

If the rod **is seen in the tip area**, it's necessary to put it into working position.

Keep the tonometer vertically with its tip downwards, as it is shown in fig.1.

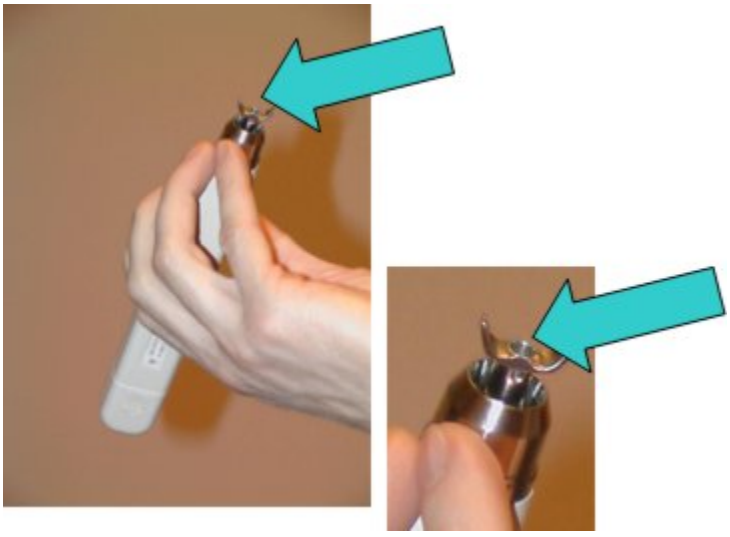

Fig. 2

Turn the tonometer with its tip upwards, as it is shown in fig. 2.

The rod automatically falls inside the tonometer.


Fig. 3

Turn the tonometer with its tip downwards.

**The rod is fixed inside the device**, as it is shown in fig.3; it means that **it is in the proper working position**.

## Turning the tonometer ON


Fig. 4

Press **momentarily** the **OPERATION** button once.

**"0000"** symbol appears on the display as it is shown in fig. 4.

If after turning ON the tonometer produces an interrupted sound signal it means that its body deviates from vertical position. Move the device so it reaches the vertical position of the tonometer and the sound signal will stop.

**IOP measuring must be realized with the tonometer's position being strictly vertical!**

To get the reliable results it is important to learn how to reach the vertical position of the tonometer before starting IOP measurement in patients.

## Practicing with the tonometer on the test plate


Fig. 5

**The testing device** is built in the tonometer's case (Fig.5). Its main assignment is checking the tonometer's capacity for work before starting the operation and when necessary.

**Use the testing device to easily find the vertical position and practice Test measurements.**

Prepare the tonometer for work — **the rod is in the working position, the tonometer is turned ON**.

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Fig. 6

Place the tonometer's tip in the indents of the testing device as it is shown in fig.6.

Reach the tonometer's **vertical** position when there's no interrupted sound signal.

Fig. 7

Fluently lower the tonometer's body down until the rod falls. The display must show the test value **from 18 to 22**, as it is shown in fig.7. The checking is finished.

At other test values the tonometer is considered inoperative.

During checking the tonometer's capacity for work keep it in the vertical position, there should be no sound signal. If after the measurement the display shows **L** symbol it means that user took the measurement while the device was beeping. It is necessary to put the rod into the working position again and repeat the operation on the testing device.

## Measuring of IOP

It is possible to measure IOP with the patient being in sitting or reclining position. **Horizontal position of the patient's head** is required.

Disinfect the tip of the tonometer with alcohol swab according to the directions of the Operation Manual.

Fig. 8a

Fig. 8b

If you are Right Handed - Stand at the LEFT hand side of the patient as it is shown in fig.8.

Put **the rod into working position, turn the tonometer ON**.

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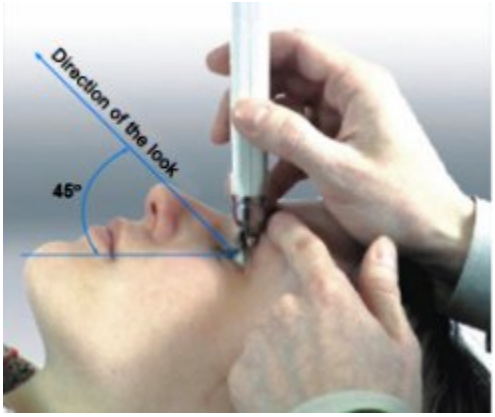

Fig. 9

Place and fix the patient's glance using the test object (extend patients Thumb forward) the patient's glance line being oriented approximately at the angle of **45°** as it is shown in fig.9.

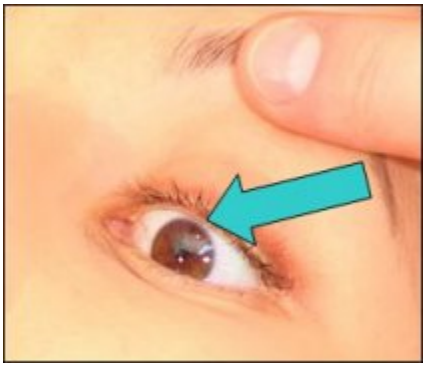
Fig. 10

Stretch the upper eyelid with a finger of a free hand so that **the edge of the upper eyelid coincides with the limb** (fig.10). Keep the eyelid in this position.

Do not press the eyeball.

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Fig. 11

Place the edge of your palm with the tonometer on the patient's forehead. With the other hand keep **holding the eyelid** in the necessary position (edge of the lid should be 1mm above the edge of the limbus) (fig.11).

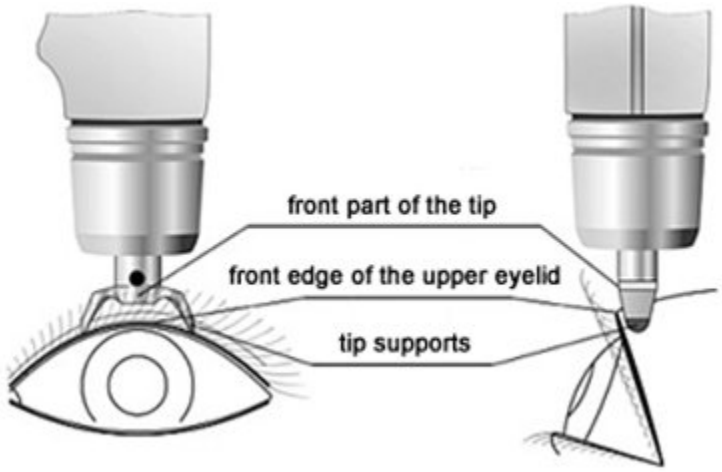


Fig. 12

Place the tonometer's tip on the eyelid in such a way that the front part of the tip is as **close to the front edge of the upper eyelid** as possible **without touching the eyelashes**. (fig.12, 13).

The influence zone of the tonometer's rod must be the part of sclera corresponding to **corona ciliaris** in 12 o'clock meridian. Secure the tonometer's **vertical position** (there's no sound signal).

**Gently** lower the tonometer's body keeping its **vertical position** until the rod falls on the eyelid which is accompanied with the short sound signal.

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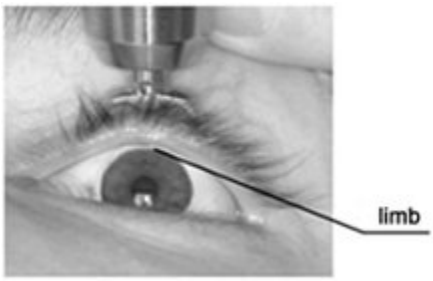



Fig. 13

**Do NOT let Eyelid slide onto the cornea during IOP measuring**
**IOP measurement is reliable only in sclera area!**


The tonometer's display shows the number of a single IOP measurement (fig.14), the digital result is recorded automatically in the tonometer's memory.

Fig. 14


Keeping the eyelid in the same position **tilt the tonometer back and forward so the rod in the working position and proceed with the measurement series** until you hear one long sound signal (or two long sound signals). Press the **OPERATION** button and you'll get the digital IOP value on the display (fig.15).

Fig. 15

**During carrying out the measuring series do not look aside the display showings!**
**You will see the IOP value only after finishing the measuring series and pressing the OPERATION button.**

## Interpretation of the obtained IOP values

| | Display indication | Result evaluation | Notes |
|---|---|---|---|
|   | Symbol **"A" and IOP value in non-flickering mode.** | The result is reliable | The IOP measuring of the eye being studied is finished |
| | Symbol **"A" in a flickering mode and IOP value in a** | The result should be considered as **approximate**, but if IOP is equal or less than 20 mm Hg it can be | If necessary carry out the new series of IOP measuring strictly following the |

| | | |
|---|---|---|
| **flickering mode.** | considered as **reliable**. | methodology. |
|  Symbol **"A 00" in a flickering mode**. | The result is considered **erroneous**. | Carry out the new series of IOP measuring strictly following the methodology. |

The tonometer is turned OFF by **momentarily pressing** of the OPERATION button, or it is turned OFF automatically in 30 seconds.

**Attention!** If you keep the OPERATION button pressed for more **than 3 seconds** the tonometer enters the auxiliary mode **the auxiliary information** being displayed. It is easy to be corrected; the detailed information can be found in Part II of Operation Manual. (To get out of this mode: Press and hold the ON button until the countdown starts 1-7, Release once you reach #7. )

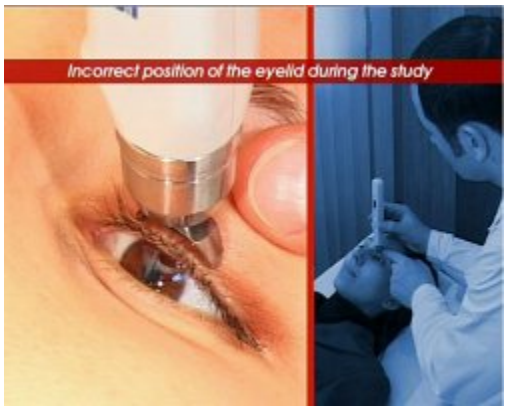
Continue taking measurements on another eye.

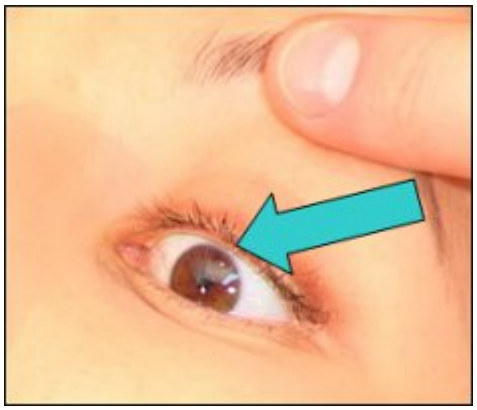
## Possible mistakes during IOP measuring

***The most common mistakes***

These are the most common mistakes during mastering the measuring methodology and lead to **significant underestimation** of the tonometry results.

| Incorrect! | Correct! |
|---|---|
| The measurement is taken **not on the sclera** (but on the limb or on the cornea). | The edge of the upper eyelid coincides with the limb |



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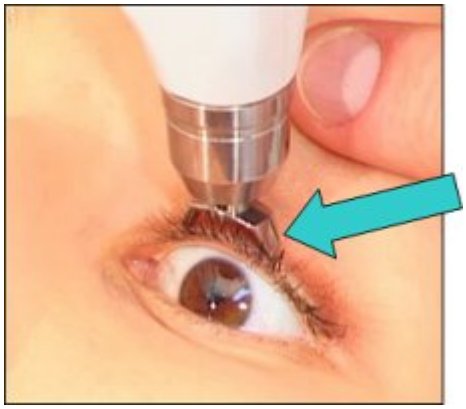
The situation can arise due the following reasons:

- You **did not coincide** the patient's upper eyelid with the edge of the limb. The eyelid slightly moved to the limb even before the measurement that's why the IOP measurement was realized not in the sclera area but on the limb or on the cornea.
- You **did not fix the eyelid** with the finger so during the measurement under the pressure of the rod **the eyelid moved** to the cornea and the measurement was carried out not in the sclera area.

| Incorrect! | Correct! |
|---|---|
| During the IOP measurement the tonometer's tip is placed **beyond the eyelid cartilage** that is not close to the ciliary edge but indented for 1 mm or more. | The front part of the tip is close to the front edge of the upper eyelid without touching the eyelashes. |

In this case the result underestimation is connected with the influence of the **eyelid viscosity** because this influence increases significantly while moving further from the ciliary edge and disfigures the tonometry results.

**Please pay attention once again to the correct position of the eyelid and the tonometer's tip- this is the most important condition of receiving the reliable results!**

## Other mistakes

| | |
|---|---|
| - nonhorizontal position of the patient's head<br>- the neck's squeeze with the collar<br>- the prolonged throwing the head back while there's the pathology of the | Result<br>underestimation<br>Result overestimation |

| | |
|---|---|
| spine's cervical section | Result overestimation |
| - non-vertical position of the tonometer | Result underestimation |
| - the edge of the eyelid is above the corneal limb<br>- the eyelid's extrophy while pulling it strongly | Result underestimation<br>Result underestimation |

More detailed information on IOP measuring methodology and the meaning of the displayed symbols you can find in the Operation Manual and in the Training Video at: http://tonometerdiaton.com/index.php?do=home.training


**SUMMARY**

DIATON® Tonometer Pen ( BiCOM Inc, USA) transpalpebral (through the eyelid, non-corneal) tonometry is an easy, quick and accurate way of measuring intraocular pressures (IOP) in patients presenting with acute eye problems. By becoming proficient with this skill, important information can be obtained which may aid in the appropriate triage and management of these challenging eye patients.


***More information about Diaton tonometer can be obtained here:***
***http://www.TonometerDiaton.com***