

# EFFECT OF PROTECTIVE EYEWEAR USE AND EVACUATION TIME ON EYE INJURIES DURING THE FIRST MANEUVER OF THE "SWORDS OF IRON" WAR

Jacob Megreli MD, MPH



## Disclosure:

No conflict of interests and no financial interest in the article's subject matter or methods described



# Acknowledgement

Dan Heller

Margarita Safir

Ori Shapira

Cole Bendor

Yoav Gutterman

Coral Yuchter

Alona Sarig

Shai Herzberger





## **IDF breaks records in life-saving response to war injuries**

Slashing time from injury to hospitalization, deploying senior practitioners to fighting units, administering blood transfusion in the field, are among new practices put in place by Medical Corps



# 7.10.23-5.8.24

Patients with ocular injury

180

3.6%

Eyes injured

221

Bilateral injury

41

23%

Right-left eye

39%

38%

Male-female

99.5%

0.5%



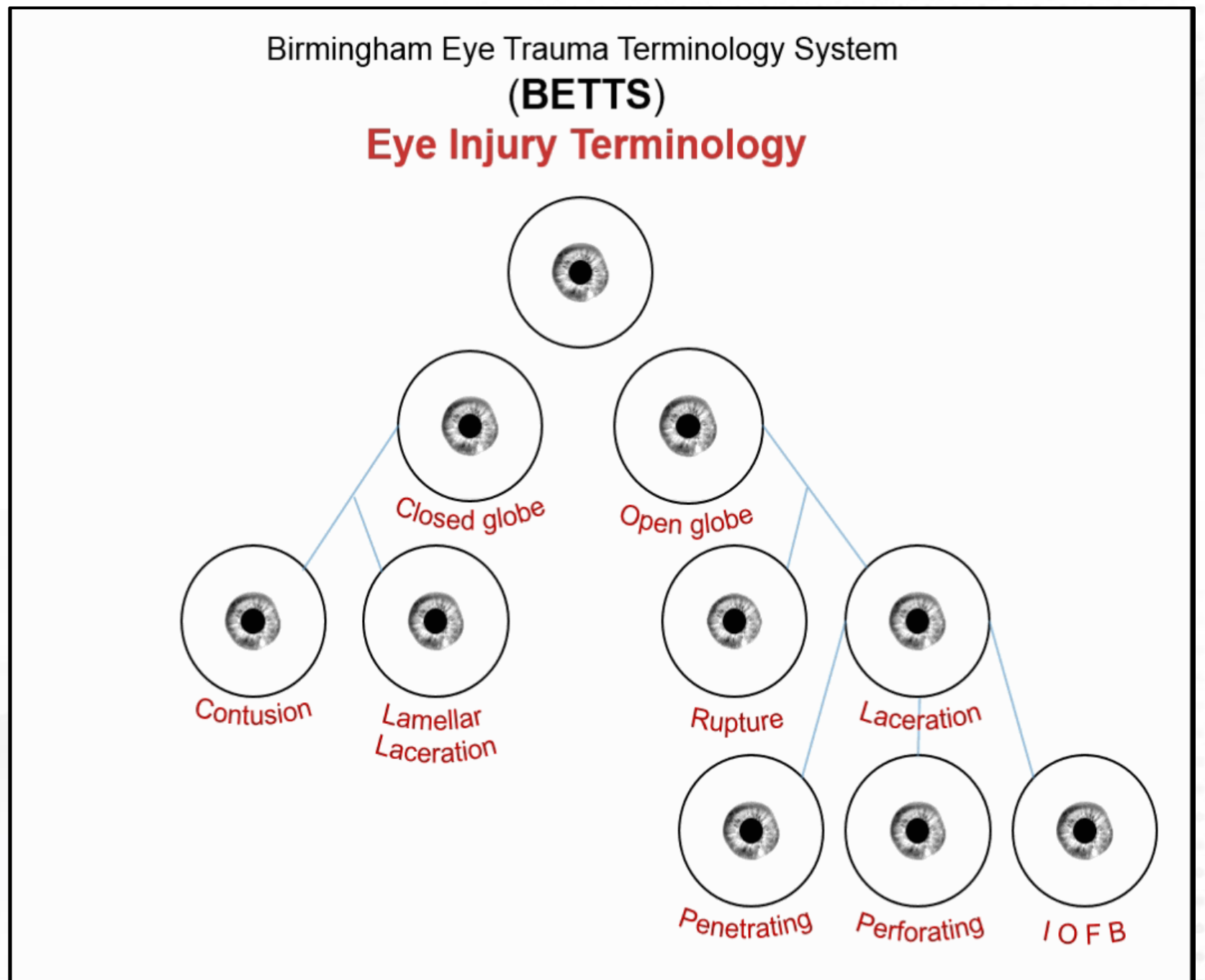
# DEMOGRAPHICS:

| Total        | CAREER     | RESERVE    | MANDATORY  |                   |               |
|--------------|------------|------------|------------|-------------------|---------------|
| 180(100%)    | 28(15.56%) | 76(42.22%) | 76(42.22%) |                   | <b>Total</b>  |
| 179(99.4%)   | 28(14.94%) | 76(42.56%) | 75(41.9%)  |                   | <b>Male</b>   |
| 1(0.6%)      | 0(0%)      | 0(0%)      | 1(0.6%)    |                   | <b>Female</b> |
|              |            |            |            |                   | <b>Age</b>    |
| <b>25.71</b> | 24.89      | 30.40      | 21.19      | Mean              |               |
| <b>6.40</b>  | 3.22       | 6.96       | 1.29       | Std.<br>Deviation |               |
| <b>19</b>    | 21         | 22         | 19         | Minimum           |               |
| <b>66</b>    | 35         | 66         | 27         | Maximum           |               |



# OCULAR INJURIES ACCORDING TO BETTS

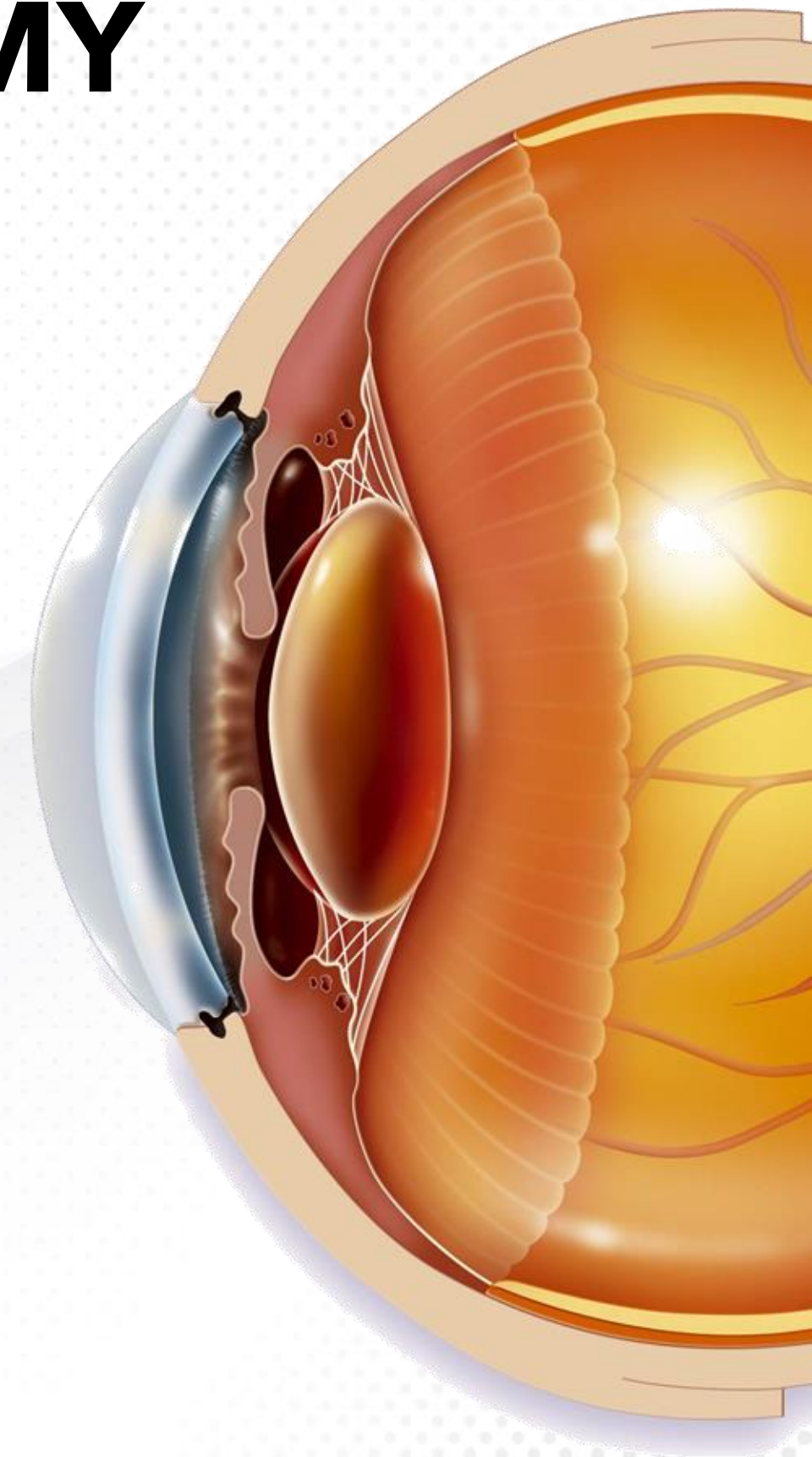
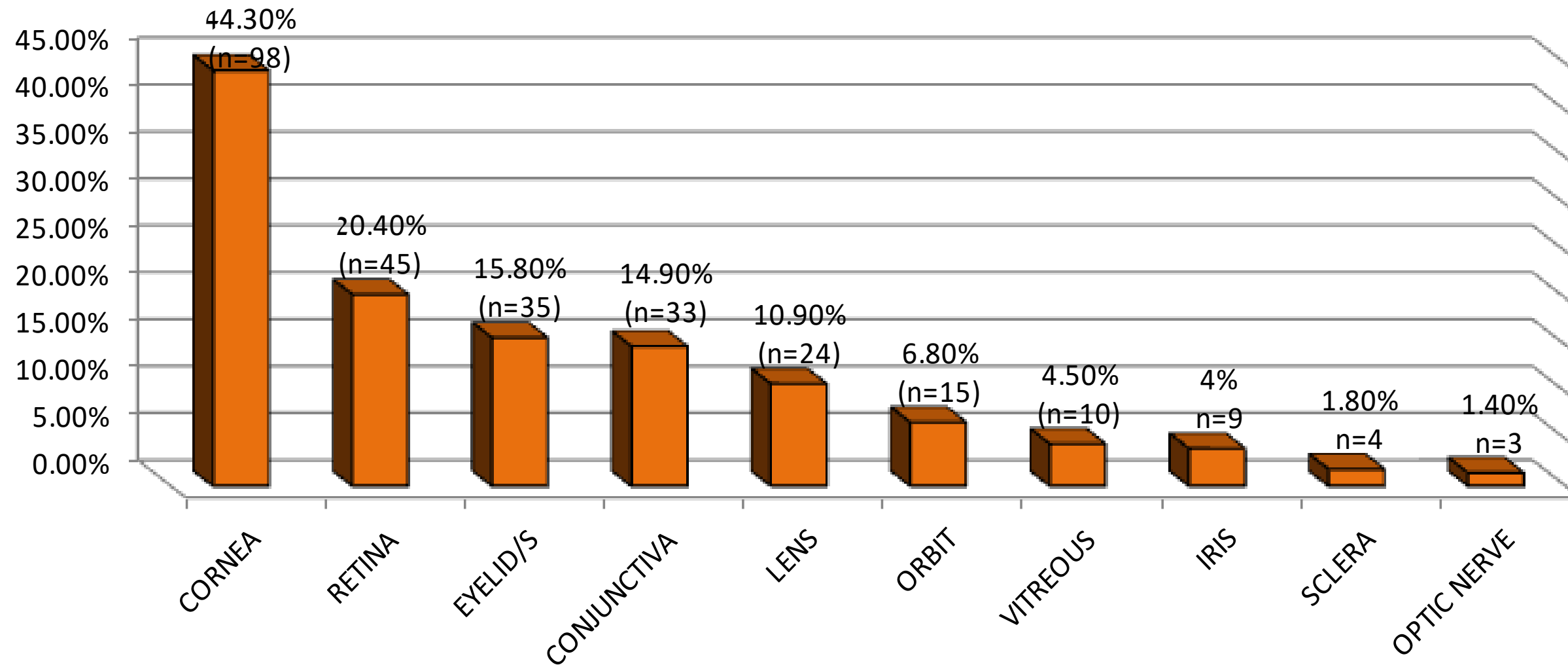
- Periocular injury 14.5% (32/221)
- Orbital injury 7% (15/221)
  - 9 cases of orbital fractures
- **Closed globe: 76.5%**
  - Eyewall injury 38% (84/221)
  - Contusion 15% (33/221)
  - Lamellar laceration 2% (5/221)
- **Open Globe: 23.5%**
  - IOFB 17% (37/221)
  - Rupture 3% (7/221)
  - Penetrating 2% (4/221)
  - Perforating 2% (4/221)



68% (148/221) of injuries caused by shrapnel



# OCULAR INJURIES - ANATOMY



# ACCOMPANYING INJURIES (108/180, 59%)

| Region      | Injured | % Injured |
|-------------|---------|-----------|
| Face        | 85      | 47%       |
| Upper limbs | 38      | 21%       |
| Neck        | 18      | 10%       |
| Lower limbs | 15      | 8%        |
| Brain       | 12      | 7%        |
| Chest       | 9       | 5%        |
| Pelvis      | 3       | 2%        |
| Abdomen     | 2       | 1%        |
| Back        | 1       | 0.5%      |
| Waist       | 1       | 0.5%      |



# FUNCTIONAL OUTCOME

Initial VA  
 $0.6 \pm 0.42$

later VA  
 $0.77 \pm 0.38$

30% required  
surgery

Temporary  
incompetence 30%

Permanent  
incompetence 16%

Evisceration /  
enucleation

Functional VA loss 1  
eye

Functional VA loss 2  
eyes

7 patients (4%)

25 patients (14%)

5 patients (3%)



# OCULAR TRAUMA SCORE

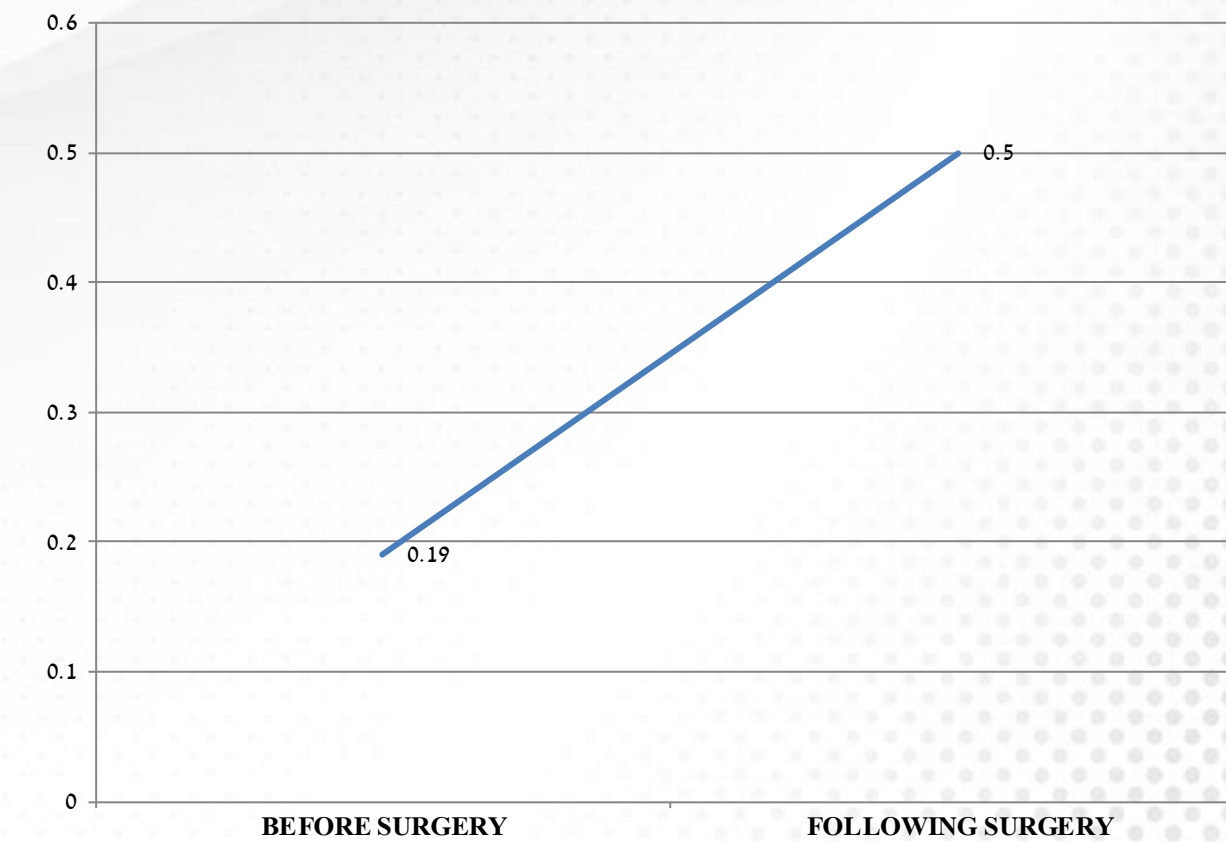
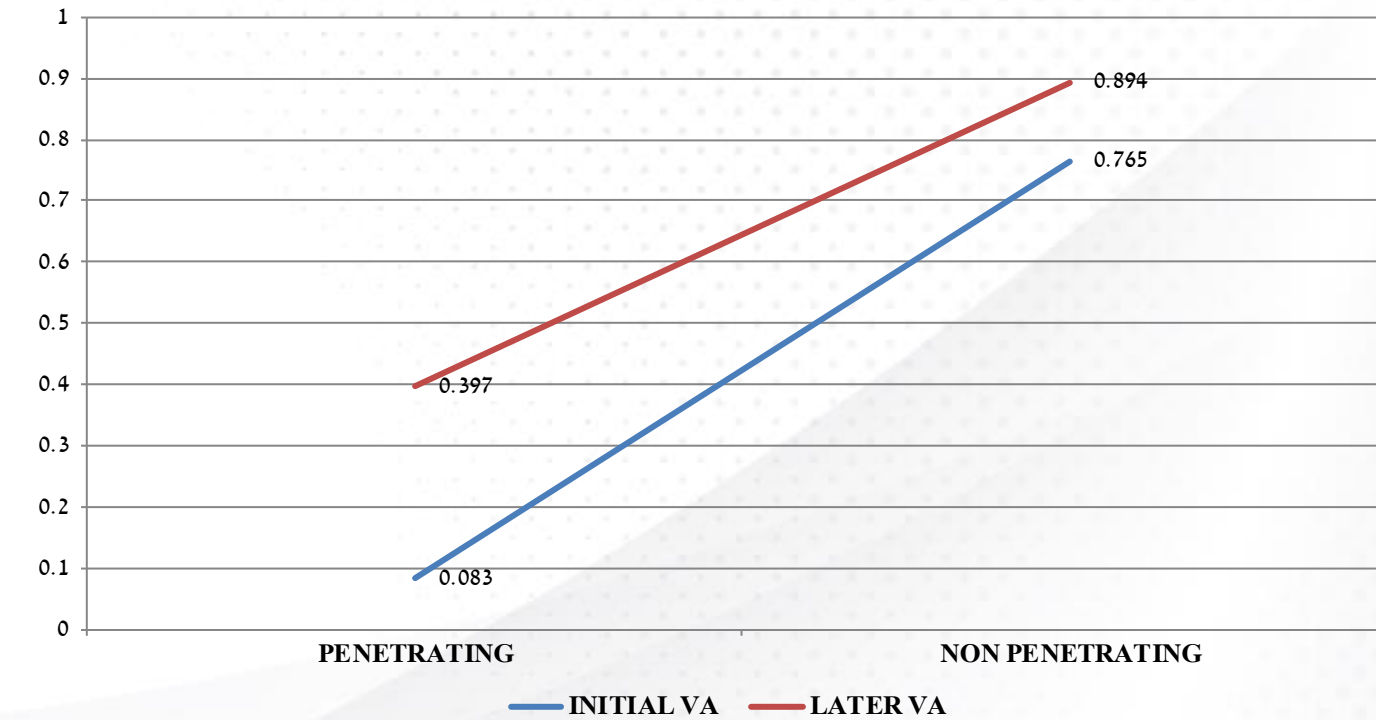
| Initial Visual Factor                            | Raw Points |
|--------------------------------------------------|------------|
| A. Initial Visual Acuity                         |            |
| >20/40                                           | 100        |
| 20/200 to 20/50                                  | 90         |
| 1/200 to 19/200                                  | 80         |
| Light perception (LP) to hand movement (HM)      | 70         |
| No light perception (NLP)                        | 60         |
| B. Afferent pupillary defect (Marcus Gunn Pupil) | -10        |
| C. Retinal Detachment                            | -11        |
| D. Perforating Injury                            | -14        |
| E. Endophthalmitis                               | -17        |
| F. Globe Rupture                                 | -23        |

| Raw score sum | OTS score | NPL | PL/HM | 1/200–19/200 | 20/200 to 20/50 | ≥20/40 |
|---------------|-----------|-----|-------|--------------|-----------------|--------|
| 0–44          | 1         | 73% | 17%   | 7%           | 2%              | 1%     |
| 45–65         | 2         | 28% | 26%   | 18%          | 13%             | 15%    |
| 66–80         | 3         | 2%  | 11%   | 15%          | 28%             | 44%    |
| 81–91         | 4         | 1%  | 2%    | 2%           | 21%             | 74%    |
| 92–100        | 5         | 0%  | 1%    | 2%           | 5%              | 92%    |



# CORRELATIONS:

- **Penetrating injury was significantly correlated ( $p < 0.001$ ) to:**
  - **Eye loss / functional vision loss**
  - **Lower initial and later VA**
  - **Long term incompetence**
  - **Need for surgical interventions**
- **Lower initial and later VA was significantly correlated ( $p < 0.001$ ) to:**
  - **Eye loss / functional vision loss**
  - **Long term incompetence**
- **Shrapnel was correlated to Lower initial VA ( $p = 0.02$ )**
- **Surgery improved VA from 0.19 to 0.5 ( $p < 0.001$ )**



# HOW TO IMPROVE PROGNOSIS

VA at presentation

Injury mechanism

Injury extensiveness

Injured anatomy

Endophthalmitis

**Prevention!!!**

**Time to treatment**



# PROTECTIVE EYEWEAR

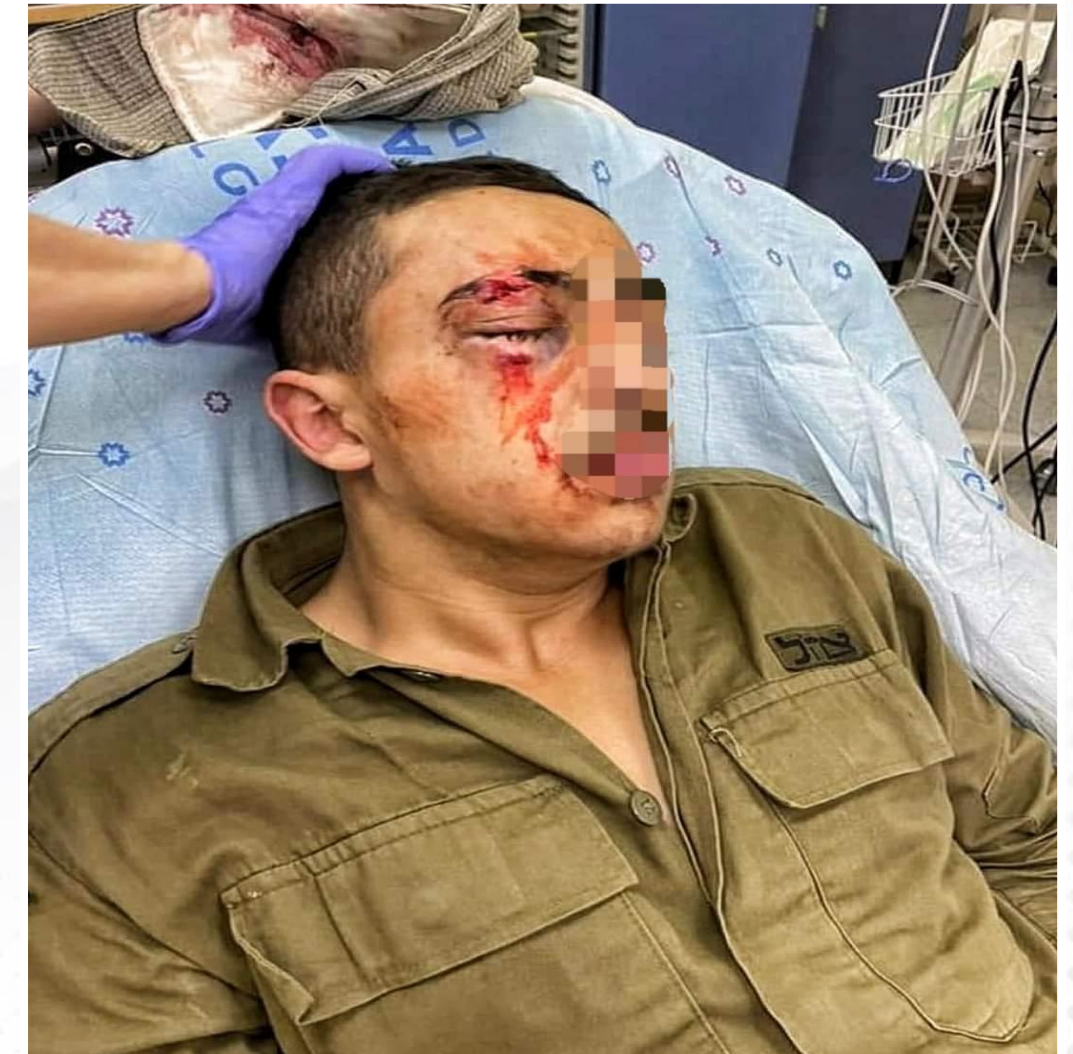
Data from retrospective questioning of 126 patients



38% (n=48) used protective eyewear during injury



62.5% (n=25/40) used APEL approved eyewear.  
Relative effectiveness?



50% less eye/ functional VA loss  
50% less long term incompetence  
50% less surgeries needed ( $p>0.05$ )



# WHAT DOES THE LITERATURE SAY?

- **Large amount of injuries but low % of overall injuries**
  - Gendler et al 1997-2005: 129 injured
  - Prat et al 1998-2017: 126 injured
  - Shakarchy-Kaminsky et al 2013-2019: 111 injured
- **Improved compliance! (38%)**
  - **Israel:** 23% between 2013-2019
  - **USA:** 27.3-31.7% (2001-2011)
- **Lower rate of penetrating injuries (23.5%)**
  - Shakarchy-Kaminsky et al- 27.6%
  - Prat et al - 29%
- **High % of shrapnel(68%)**
  - Shakarchy-Kaminsky et al- 29%



➤ [Injury](#). 2015 Jul;46(7):1241-4. doi: 10.1016/j.injury.2015.01.035. Epub 2015 Jan 30.

## Eye injury in the Israeli Defense Force: "an ounce of prevention is worth a pound of cure"

Sami Gendler <sup>1</sup>, Roy Nadler <sup>2</sup>, Tomer Erlich <sup>2</sup>, Ofir Fogel <sup>3</sup>, Guy Shushan <sup>4</sup>, Elon Glassberg <sup>2</sup>

➤ [Injury](#). 2021 Feb;52(2):292-298. doi: 10.1016/j.injury.2020.09.041. Epub 2020 Sep 18.

## Ocular injuries incurred by Israeli defense forces during low-intensity conflicts

Daphna Prat <sup>1</sup>, Erez Tsumi <sup>2</sup>, Shiran Madgar <sup>1</sup>, Hila Goldberg <sup>1</sup>, Ofira Zloto <sup>1</sup>, Perach Osaadon <sup>2</sup>, Liza Tal Mushinski <sup>2</sup>, Jacob Chen <sup>3</sup>, Roy Nadler <sup>3</sup>, Joseph Moisseiev <sup>1</sup>, Amir Alhalel <sup>1</sup>, Guy J Ben Simon <sup>4</sup>

➤ [J Trauma Acute Care Surg](#). 2021 Aug 1;91(2S Suppl 2):S241-S246. doi: 10.1097/TA.0000000000003233.

## Combat-related ocular injuries in the Israel Defense Forces during the years 2013 to 2019

Nitzan Shakarchy-Kaminsky <sup>1</sup>, Jacob Megreli, Dan Kaminsky, Avishai M Tsur, Roy Nadler, Irina Radomislensky, Shaul Gelikas, Elon Glassberg, Avi Benov, Ariel Furer



## PROGRAM EXECUTIVE OFFICE SOLDIER




[Home](#)
[About](#)
[Program Offices ▾](#)
[Equipment ▾](#)
[Resources ▾](#)
[Contact ▾](#)
[News](#)

# Authorized Protective Eyewear List (APEL®)

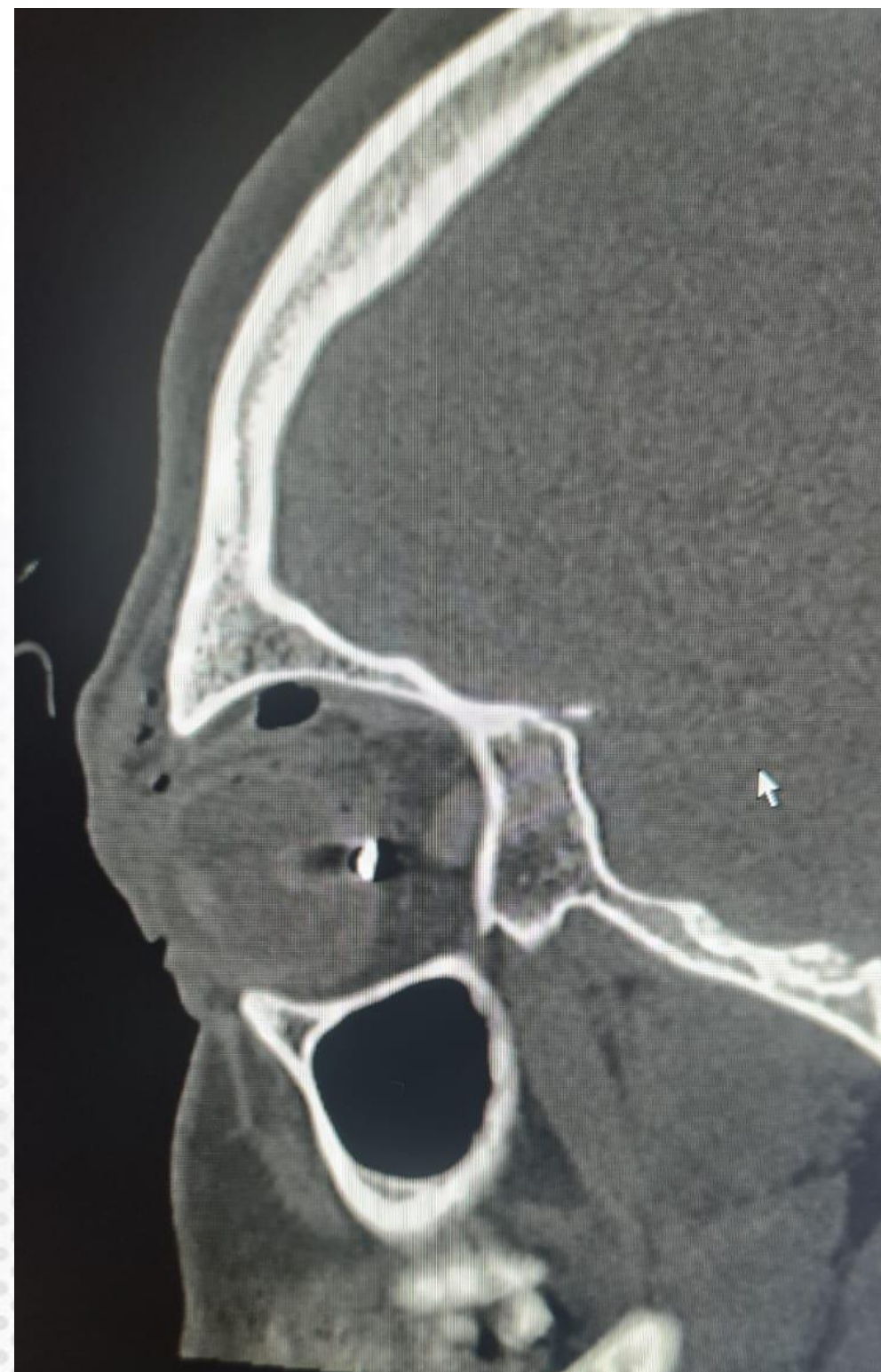
*Current as of 24 Jan 2024*

Qualified Products List (QPL) is a list of manufacturers who have had their products examined and tested and who have satisfied all applicable qualification requirements for that product. The QPL for eyewear protection is the Authorized Protective Eyewear List (APEL®). The following eyewear meet Army standards for ballistic protection.



At the moment of truth,  
**IDF MEDICAL CORPS.**





# REASONS FOR NON-COMPLIANCE

Reduced visual quality

Inconvenience

False sense of security

Not provided by unit?



# TIME TO TREATMENT

>24 hours from perforation to repair

Endophthalmitis ↑

> Clin Exp Ophthalmol. 2015 Aug;43(6):508-13. doi: 10.1111/ceo.12511. Epub 2015 Jun 19.

## Wound-related complications and clinical outcomes following open globe injury repair

George Y X Kong<sup>1 2</sup>, Robert H Henderson<sup>1</sup>, Sukhpal S Sandhu<sup>1 2 3</sup>, Rohan W Essex<sup>1 4</sup>, Penelope J Allen<sup>1 2 3</sup>, William G Campbell<sup>1</sup>

Review

> Br J Ophthalmol. 2010 Jan;94(1):111-4. doi: 10.1136/bjo.2009.164913. Epub 2009 Aug 18.

## Endophthalmitis following open globe injury

Y Zhang<sup>1</sup>, M N Zhang, C H Jiang, Y Yao, K Zhang

5-24 hours from perforation to repair

Endophthalmitis same

> Graefes Arch Clin Exp Ophthalmol. 2023 Apr;261(4):1195-1203. doi: 10.1007/s00417-022-05904-2. Epub 2022 Nov 16.

## The impact of primary repair timing on longitudinal visual outcomes after open globe injury

Roger K Henry<sup>1 2</sup>, Albert Bargoud<sup>2</sup>, Sapna Syal<sup>1 2</sup>, Abanoob Tadrosse<sup>2</sup>, Ibraheem S Shaikh<sup>2</sup>, Robert L Kost<sup>3</sup>, Albert S Khouri<sup>4</sup>



# TIME TO TREATMENT

Open globe injury → 1:100 endophthalmitis

Data from National Trauma Registry and medical files

Average time to hospital 295.56min ( $\pm 377.54$ )

221 eyes

1 endophthalmitis

Evacuation time  $\leq 1$  hour – better initial VA! (only 18.75% lower than 20/200 VS 29.6%) ( $P=0.005$ )



# **LIMITATIONS**

- **Retrospective study - selection bias**
- **Reporting bias**
- **Small sample size**
- **Partial information:**
  - **Injury mechanism**
  - **Protective eyewear specific models**
  - **Variable follow-up period**



# CONCLUSIONS

- **Protective eyewear use is essential !**
- **Optimal time to treatment time  $\leq 1$  hour**
- **Rapid evacuation time improved initial VA and allowed for very low endophthalmitis rates.**

VA at presentation

Endophthalmitis

**Prevention!!!**

**Time to treatment  $\leq 1$  hour**



# THANK YOU FOR YOUR ATTENTION!

