

A Comprehensive Case Series of IOFB Injuries: Demographics, Diagnosis, Management, and Outcomes of Patients Treated by a Single Surgeon in Southern Alberta

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BACKGROUND

Although the incidence of intraocular foreign bodies (IOFB) in the general population is low, they make up a significant proportion of open-globe injuries (OGI) globally and may lead to various types of eye intraocular pathologies. Studies have shown that most IOFB injuries affect young males and are sustained in a workplace setting. Several studies have discussed the demographics, management approaches, and clinical outcomes of IOFB injuries. However, no Western Canadian IOFB studies have investigated these variables and factors. Therefore, this retrospective case series aims to further understand IOFB injuries within Southern Alberta.

PURPOSE

To understand the demographics, diagnostic imaging, management, outcomes, and nature of IOFB injuries within an urban Western Canadian context.

METHODS

Study Design: Retrospective chart review of patients who received care from a single surgeon between 2002 to 2022. Data collected included demographics, IOFB characterization, assessments, treatments, related injuries/complications, as well as the initial and final best corrected visual acuity (BCVA).

Outcome Measures

Demographics & Characterization

Assessment & Treatment

Associated Injuries & Complications

Initial & Final BCVA

OUTCOMES

Baseline Demographics

| Variable | Result |
|---------------------------|---------------------------------|
| Number of Cases | 31 (32) |
| Age | Median (Range) 32 (14 - 71) |
| Sex | Male/Female 31/32 |
| Follow-up Duration (days) | Median (Range) 388 (4 - 6413) |
| Work Related Injury | Yes 15 (46.9%) No 17 (53.1%) |

Table 1 - Baseline patient characteristics in the study population

This study evaluated 32 eyes from 31 patients, with a median follow-up of 388 days. The median age on injury was 32 years, with 31 (97%) of eyes belonging to male patients.

IOFB Characterization

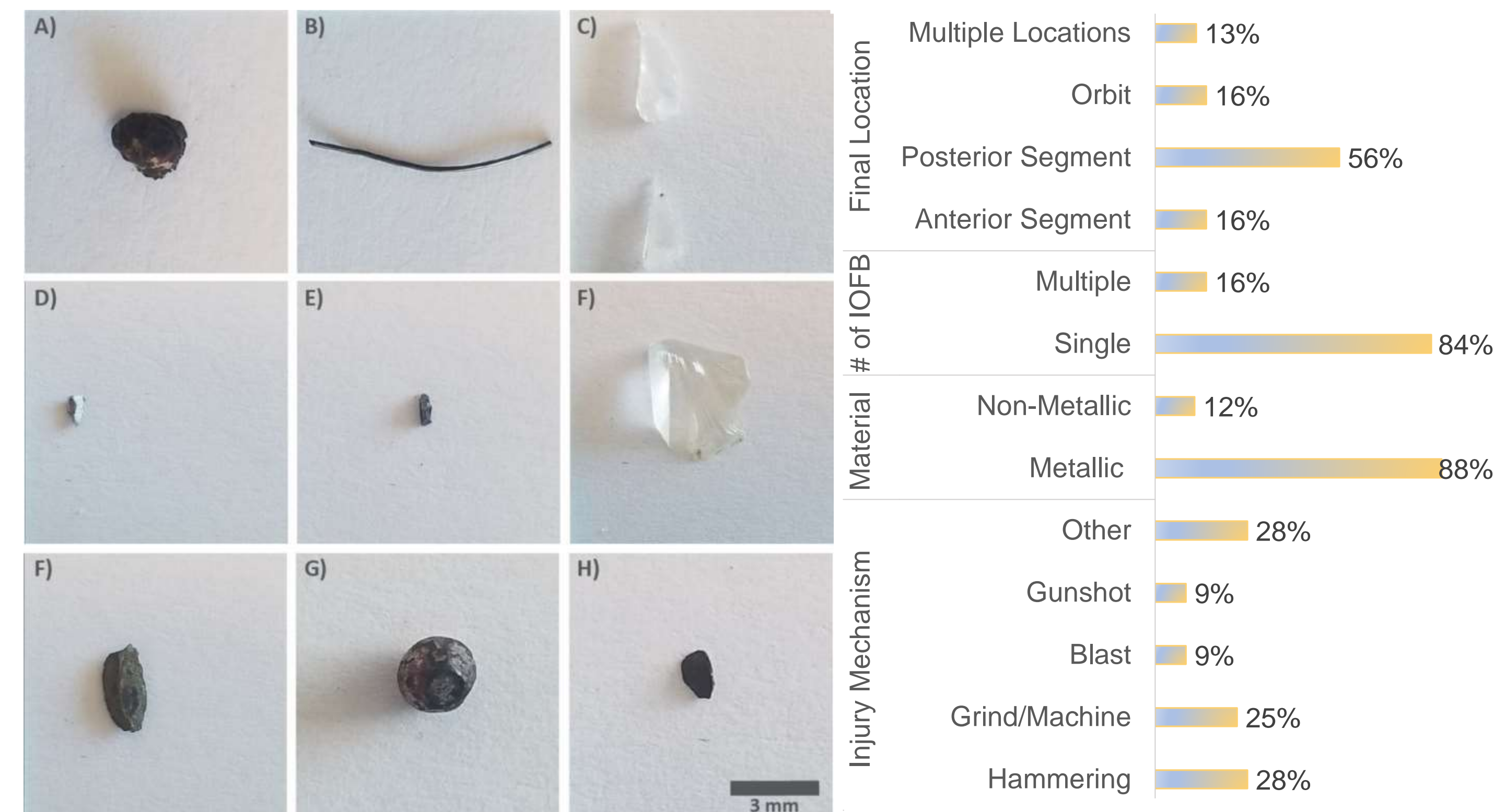


Figure 1 - Sample photographs of Intraocular Foreign Bodies (IOFB) extracted from the eyes of patients included in this study

The IOFB sizes ranged from 1-12 mm, with a median size of 3 mm. Of the total 32 IOFB cases, 28 (88%) were metallic and 15 (47%) resulted from work-related injuries. Among these cases, 27 eyes (84%) had a single IOFB, while 5 (16%) IOFBs perforated through the globe. The most common mechanisms of injury were hammer and grind/machine injuries, which accounted for a combined 17 out of 32 (53%) cases.

IOFB Assessment & Imaging

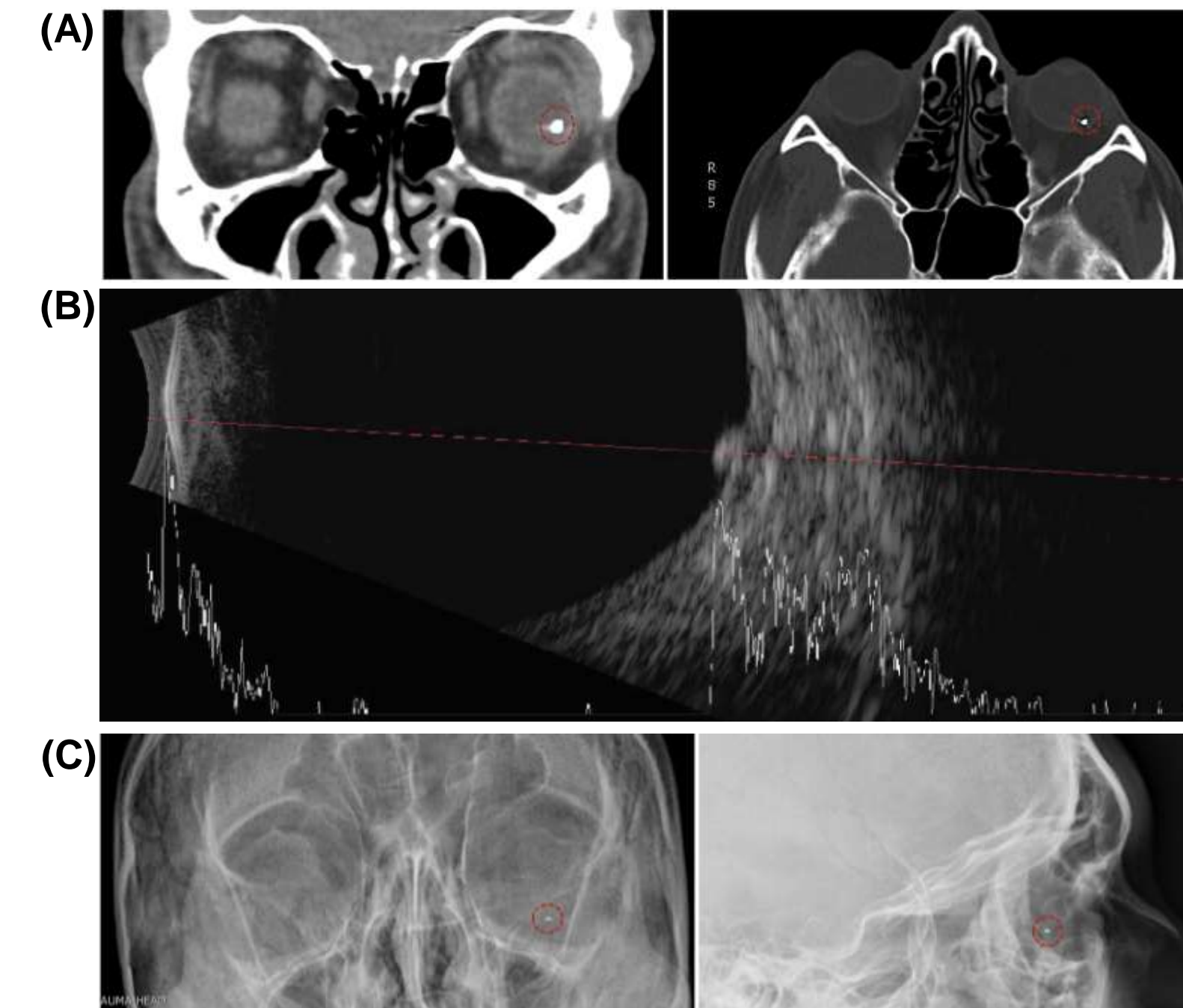


Figure 4 - IOFB imaging modality for patients included in this study (A) CT of 3 mm IOFB in the temporal macula of the retina (B) B-scan of a 1.5 mm in the Inferotemporal Retina (C) x-ray of 3 mm intraocular foreign body in the temporal macula

| Imaging | Pros | Cons |
|---------|-----------------------------------------------------|----------------------------------------------------------|
| CT Scan | • Most sensitive imaging • No globe manipulation | • Cost and Access • Ionizing radiation |
| B-Scan | • Low cost • No ionizing radiation | • Operator dependent • Higher risk with OGI |
| X-ray | • Accessible w/o training • Screening test | • Occult IOFB detection • Non-metallic IOFB detection |

Table 2 - Comparison primary imaging modalities using as initial diagnostic images for study sample

The most common initial imaging modality for patients presenting with an IOFB was CT in 19 (61%) patients and B-scan in 8 (26%) patients. Two (6.5%) x-ray screenings were done for open globe injuries to reduce radiation exposure. Clinical diagnosis was made in two (6.5%) cases where IOFBs were obvious or urgent surgery was needed.

Associated Injuries & Common Complications

| Associated Injuries / Complications | Total Frequency |
|-------------------------------------|-----------------|
| Lens Injury / Traumatic Cataract | 27 |
| Vitreous Hemorrhage | 15 |
| Corneal Injury/Inflammation | 14 |
| Iris Injury/Inflammation | 12 |
| Hyphe | 11 |
| Retinal Tear | 10 |
| Retinal Detachment | 10 |
| Epiretinal Membrane | 9 |
| Secondary Glaucoma | 3 |
| Endophthalmitis | 2 |
| Enucleation | 2 |
| Lateral rectus muscle Injury | 2 |
| Siderosis | 1 |
| Antibiotic drug toxicity | 1 |
| Proliferative vitreoretinopathy | 1 |

Table 3 - Timeline of Interventions and Associated Complications on Presentation of IOFB

The two most common complications observed were traumatic cataract in 27 (84%) eyes and vitreous hemorrhage in 15 (47%) eyes. Both immediate and delayed uncommon complications were observed, including siderosis and proliferative vitreoretinopathy in one (3%) eye each, and endophthalmitis, enucleation, and rectus muscle injury in two eyes each (6%). All nine epiretinal membranes and four retinal detachments formed more than a month following the injury.

Best Corrected Visual Acuity

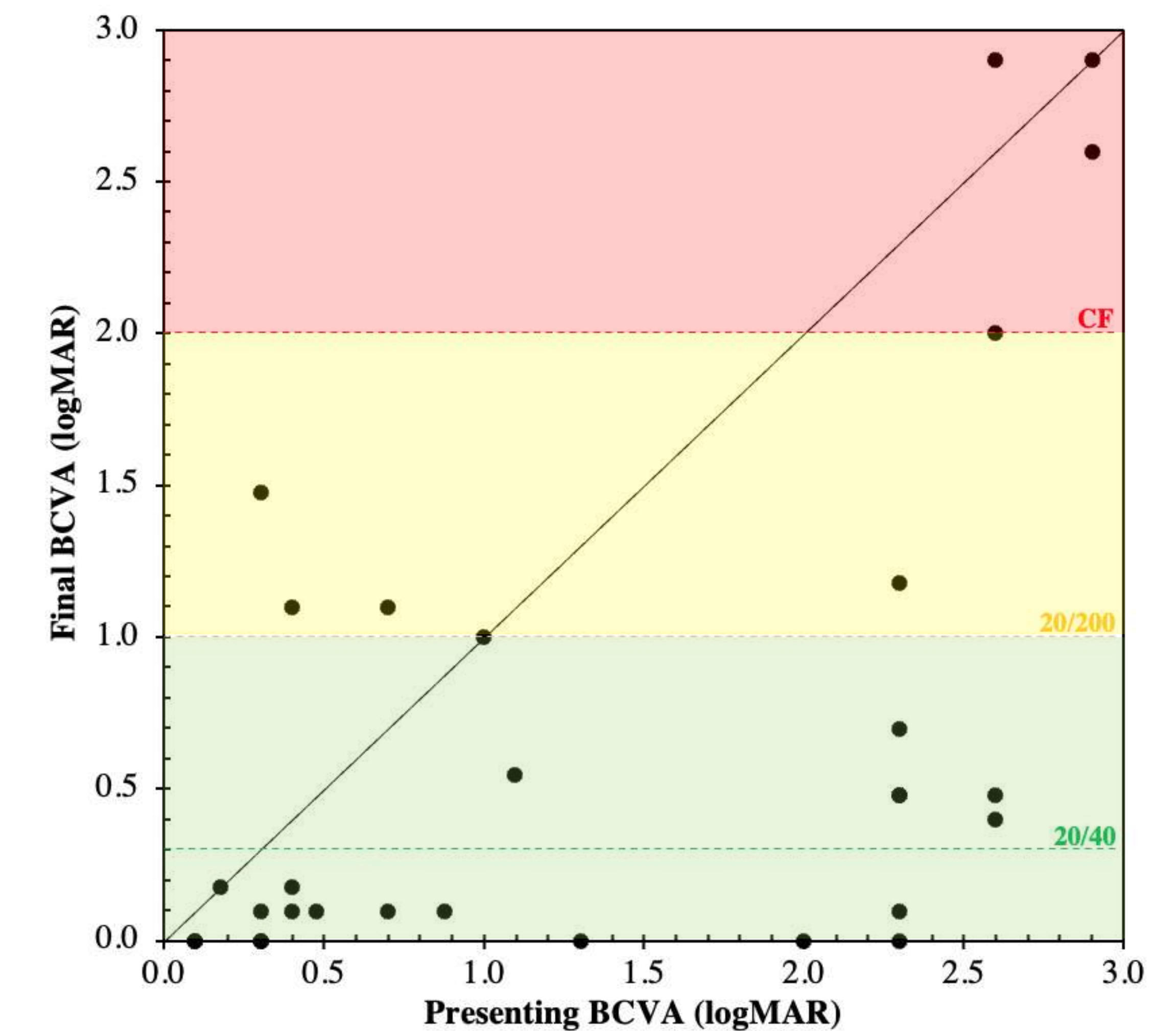
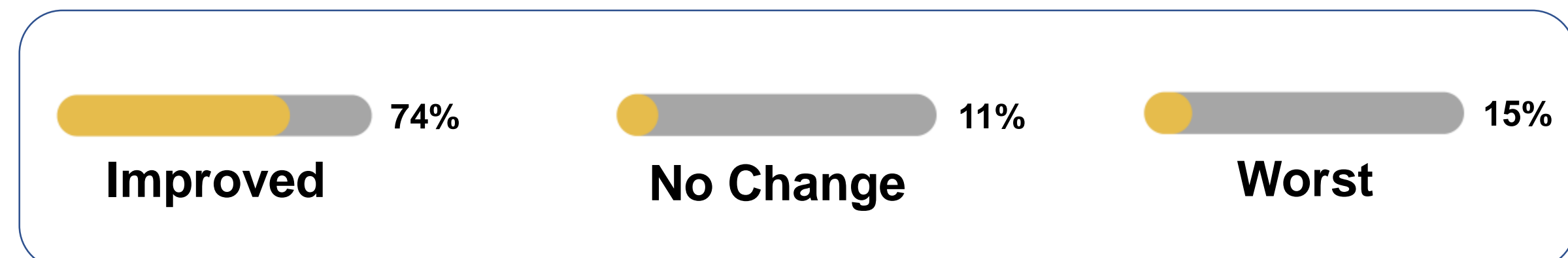


Figure 4 - Scatter plot of the BCVA for each respective eye. The points on the diagonal line represent cases where there was no change in BCVA, while points above the line represent a decrease in BCVA, and points below the line represent an improvement in BCVA.



At final follow-up, BCVA was $\geq 20/40$ in 17 eyes (53%), compared to only 7 eyes (22%) at presentation. Patients who presented with BCVA $\geq 20/200$ were more likely to achieve final BCVA $\geq 20/40$ ($p=0.027$). The IOFB was removed in 28 eyes (88%), of which 21 (75%) were extracted within 24 hours of injury. The IOFB was retained in 3 eyes (9%), and one eye (3%) required acute enucleation.

DISCUSSION & CONCLUSIONS

- Demographics** - The average age, higher proportion of male patients, and greater incidence of metallic IOFBs observed in this study are consistent with findings from other large cohort studies conducted in the United States and China. Although work-related injuries are often the primary cause of IOFBs in studies from these countries, this study found that only 46.9% of the injuries were work-related. Additionally, while weapon-related injuries accounted for 19% of IOFB cases in the US, this study recorded only three accidental gunshot injuries, which comprised 9.4% of the cases.
- Imaging** - According to the literature, CT scans are the most sensitive imaging modality and are preferred in emergency settings due to their availability and convenience. MRI and B-scan imaging are appropriate additional tests, but in Canada, limited accessibility to MRI and the risk of harm associated with metal IOFBs make it impractical. To reduce radiation exposure, B-scan is a reasonable initial test, especially for closed-globe and non-metal IOFB cases. X-rays can be used as screening tests for metal IOFBs but may require follow-up images if no IOFB is identified in the context of a strong clinical history.
- Surgical approach and strategy** - Involved performing surgery under general anesthesia, repairing the penetrating site in a stepwise and methodical manner, addressing both the anterior and posterior segments, and extracting the IOFB.
- Complications** - Similar to studies reported in the literature, vitreous hemorrhage and traumatic cataract were some of the most common complications observed. In our study, complications were captured throughout the entire follow-up period of patients. We observed 9 eyes (28%) had developed ERM, all of which occurred more than a month after the initial trauma. This complication may not be captured in other studies where only the initial presenting injuries and complications are noted.
- Significance** - This study provides valuable insight into the diagnosis, treatment, and outcomes of IOFB injuries in Southern Alberta. Clinical measures were stratified by timeframes, with the late-presenting complications highlighting the importance of extended follow-up for timely intervention. The study participants had a lower incidence of work-related injuries, indicating a strong workplace safety culture and emphasizing the need for protective eyewear in extracurricular settings.

REFERENCES

