

OCULAR INJURIES IN COMBAT SPORTS: ANALYSIS OF MECHANISMS, DIAGNOSTIC CHALLENGES, AND PREVENTIVE MEASURES (2015–2025)

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Keywords: ocular trauma, combat sports, eye injuries, diagnostics, prevention, retinal detachment, lens displacement.

Summary

Ocular trauma is a significant concern in combat sports, where high-impact strikes frequently cause injuries ranging from mild superficial lesions to severe anterior or posterior segment damage capable of impairing vision. This narrative review examines ocular injury mechanisms in boxing, mixed martial arts, kickboxing, and other combat disciplines, describing the typical effects of blunt impacts that lead to eyelid lacerations, hyphema, orbital fractures, lens displacement, vitreous hemorrhage, retinal tears, and retinal detachment. Diagnostic evaluation is often complicated by periorbital swelling, pain, and media opacity, which may delay recognition of posterior segment pathology, while modern imaging techniques—including ocular ultrasonography, computed tomography, and optical coherence tomography—enhance early diagnosis and treatment planning. The review also summarizes evidence-based preventive measures, such as appropriate protective equipment, adherence to safety regulations, medical screening, and rapid assessment by ringside medical personnel, all of which contribute to reducing the risk of severe ocular injuries. A deeper understanding of trauma mechanisms, diagnostic limitations, and prevention strategies is essential for decreasing the incidence and severity of ocular injuries in combat sports.

Introduction

Combat sports such as boxing, mixed martial arts (MMA), kickboxing, and related disciplines pose a substantial risk of craniofacial trauma due to the intentional and

repeated delivery of high-energy strikes to the head and upper body. Among these, ocular trauma stands out as both prevalent and potentially career-threatening, even in the absence of immediate visual symptoms). The delicate anatomical structures of the eye—particularly the orbit, retina, and cornea—are vulnerable to both acute blunt force and cumulative microtrauma, with consequences ranging from minor abrasions to irreversible vision loss [1].

Despite ongoing efforts to enhance safety through rule modifications and protective equipment mandates, recent data suggest that eye injuries remain a persistent concern in combat sports. Flitsos et al. (2021) reported that 73.3% of professional MMA events in Nevada involved at least one documented eye injury, with similar trends noted across boxing and kickboxing. Injuries frequently include orbital fractures, retinal tears, hyphema, and corneal abrasions, often underdiagnosed or managed inconsistently due to limited ringside resources and the absence of standardized return-to-play protocols [2].

While individual studies have examined injury types or reported isolated epidemiological findings, a comprehensive review comparing mechanisms, clinical challenges, and prevention strategies across combat sports remains lacking. Moreover, diagnostic and reporting limitations—such as injury underreporting or limited access to ophthalmologic evaluation—complicate interpretation and delay optimal care.

This literature review aims to synthesize current evidence from 2015 to 2025 on: 1. The mechanisms and anatomical distribution of ocular injuries in combat sports. 2. The diagnostic limitations and clinical challenges in managing such injuries. 3. Existing preventive strategies and opportunities for evidence-based improvement.

By mapping the patterns and gaps in current data, this review supports clinicians, ringside physicians, and sport's governing bodies in designing safer practices for combat athletes globally.

Methodology

This narrative literature review was conducted to synthesize current knowledge on ocular trauma in combat sports, specifically focusing on mechanisms, clinical management, and prevention. A comprehensive search was carried out across PubMed and Google Scholar databases using the following keywords: *ocular trauma, eye injury, combat sports, mixed martial arts (MMA), boxing, kickboxing, and martial arts*. The search was limited to English-language studies involving human subjects published between January 2015 and June 2025.

Out of an initial 115 screened titles, 42 studies met preliminary criteria. After reviewing abstracts and full texts for relevance, a final selection of 11 studies was included. These consisted of:

- 6 retrospective cohort studies
- 2 prospective or cross-sectional clinical evaluations
- 2 registry/database-based injury analyses
- 1 review paper focused on clinical evaluation guidelines

The included studies represented diverse geographic regions notably Northern America, Asia, Europe and Africa. Data was extracted on study design, population, injury types, affected anatomical structures, clinical recommendations, and proposed prevention measures. A standardized extraction table was created for internal synthesis.

Results

Mechanisms of Ocular Trauma. Across the reviewed literature, ocular injuries in combat sports are primarily caused by direct blunt trauma, typically from strikes such as punches, elbows, knees, or accidental eye pokes. The mechanisms vary by discipline:

- **Boxing:** Punches with padded gloves are the predominant mechanism. Although the gloves reduce sharp trauma, they still deliver sufficient force to cause orbital fractures, hyphema, and lid lacerations [2,3,4].
- **MMA:** Injuries result from a broader set of trauma types, including punches, kicks, takedowns, and ground-and-pound strikes. MMA gloves are lighter and fingerless, increasing the risk of corneal abrasions, open globe injuries, and eye pokes and acute trauma [2,3,4].
- **Kickboxing:** Presents a hybrid risk profile, with high involvement of limb strikes and facial trauma, though data is more limited [4].

Akano et al. highlighted that MMA fighters experience a wider range of ocular injuries than boxers, identifying 25 unique injury types in MMA compared to 13 in boxing, likely due to the increased diversity of legal striking mechanisms and glove differences [4].

Anatomical distribution of Injuries. The affected

structures include both anterior and posterior segments of the eye, as well as periocular soft tissues and orbital bones.

Anterior segment (most common)

• **Corneal abrasions** – Frequently observed in MMA due to glove structure [2,3].

• **Hyphema** – Often following direct frontal impact [2].

• **Subconjunctival haemorrhage and iris trauma** [1,5].

Posterior segment

• **Retinal tears, lattice degeneration, and vitreous haemorrhage** were reported in both professional and amateur boxers, sometimes asymptotically, underscoring the risk of cumulative microtrauma [1,5,6].

• Arej et al. found peripheral retinal lesions in 40% of boxers examined during screening, often without symptoms [7].

Orbital and periocular

• **Eyelid and eyebrow lacerations** – Most prevalent soft-tissue injury, especially in boxing [2,3,8].

• **Orbital fractures** – MMA fighters were significantly more affected, with rates up to 17.6% of all ocular injuries in MMA [2,3].

• **Orbital compartment syndrome** was rare but noted as a sight-threatening emergency following retrobulbar haemorrhage [9].

Flitsos et al. reported that 73.3% of MMA events involved at least one ocular injury, and that 74% of fighters with such injuries lost their bout, linking eye trauma with poor fight outcomes [2].

Kagmeni and Moosa emphasized the degenerative, cumulative nature of trauma in athletes with long careers or poor protective practices, reporting findings such as corneal scarring, lens opacities, and retinal degeneration, particularly in older or higher-weight-class athletes [1,5].

Diagnostic Limitations and Clinical Challenges. Despite growing awareness of ocular trauma in combat sports, the diagnostic process remains hampered by several limitations at both ringside and clinical levels.

Limitations in ringside evaluations

Ringside physicians—often not ophthalmologists—are typically tasked with rapid assessments under time constraints and suboptimal conditions. Most lack specialized tools necessary for accurate diagnosis. For example, Flitsos et al. [2] noted that orbital fractures were diagnosed solely through physical examination without imaging, raising the likelihood of underreporting or misdiagnosis.

Chang et al. [3] similarly acknowledged uncertainty regarding the training and skill level of the ringside physicians across events. This variability can affect injury documentation quality and downstream medical care. While standardized tools such as ophthalmoscopes and fluorescein strips

are recommended [9], they are inconsistently available and underutilized at live events.

Toldi et al. [9] proposed a structured ringside eye examination protocol, including key steps such as Snellen acuity testing, confrontation visual fields, extraocular movement testing, and anterior chamber inspection. However, this protocol remains non-mandatory, and real-world implementation appears limited.

Underreporting and athlete hesitancy

Multiple studies have identified systemic underreporting as a barrier to accurate injury surveillance. Athletes may deliberately withhold symptoms like blurred vision or photopsia to avoid disqualification. Kagmeni et al. [1] and Moosa et al. [3] noted that many boxers were reluctant to report symptoms due to fear of suspension or career interruption.

Akano et al. [5] also highlighted that ringside documentation typically occurs within one hour of the bout's conclusion, meaning that delayed-onset symptoms, such as retinal detachment or vitreous hemorrhage, may be missed entirely.

Asymptomatic and cumulative pathology

A unique challenge in combat sports is the prevalence of asymptomatic but progressive injuries. Arej et al. [10] found peripheral retinal lesions in 40% of boxers through screening, despite participants being entirely asymptomatic. These lesions carry a risk of progression to retinal detachment, especially if undetected and unmanaged.

Moosa et al. [5] and Kagmeni et al. [1] reported cases of early-stage cataracts, lens subluxation, and angle abnormalities—all present in active fighters without visual complaints. Such injuries are often only detectable with specialized equipment (e.g., dilated fundus exams, gonioscopy, OCT), underscoring the inadequacy of basic screenings.

Toldi et al. [9] and Arej et al. [10] further stressed that reliance on symptom-based evaluation is insufficient in sports where athletes often normalize visual disturbances.

Imaging access and resource limitations

In low-resource settings or amateur circuits, access to imaging such as CT scans for orbital trauma or OCT for retinal evaluation is often unavailable. Kagmeni et al. [1] and Moosa et al. [3] operated in African and Indian cohorts respectively, and both pointed to infrastructural limitations that impaired follow-up and diagnosis of subtle but significant injuries.

Even in developed settings, Akano et al. [7] warned that non-imaging-based assessments might underestimate injury severity, particularly for orbital or intraocular trauma.

Preventative Strategies and Recommendations. Despite the high risk of ocular trauma in combat sports, evidence suggests that injury prevention is feasible through a combination of equipment, screening, and athlete education.

Protective equipment

The use of protective headgear with orbital padding has been shown to reduce the incidence of superficial ocular injuries — particularly in amateur settings. Governing bodies such as AIBA and IMMAF recommend or mandate its use during sparring and competition in younger divisions [2,4,9].

However, protective gear remains controversial at the professional level due to:

- Visual field restriction
- Reduced peripheral awareness
- Perceived interference with performance [2,4]

Glove design also contributes to injury risk. Studies noted that MMA fingerless gloves increase the likelihood of corneal abrasions and orbital injuries, compared to padded boxing gloves [3,4].

Pre-participation and routine screening

Proactive ophthalmologic screening has proven effective in identifying asymptomatic but vision-threatening pathology, such as:

- Peripheral retinal lesions
- Lattice degeneration
- Early cataract or glaucoma signs [5,7]

Arej et al. found that 40% of boxers had peripheral retinal lesions despite being asymptomatic, underscoring the value of dilated fundus exams in pre-fight evaluations [7].

Oska et al. and Moosa et al. also support routine eye exams as part of regular monitoring in active fighters [5,10].

More advanced imaging such as optical coherence tomography (OCT) and visual field testing may be warranted in high-risk athletes, particularly those with long careers or prior ocular trauma [5,7].

Education and reporting

Athlete and coach education remains underused but crucial. Oska et al. emphasize the need for fighters to understand symptoms of eye injury (e.g., blurred vision, floaters, flashes) and report them early [10].

Delayed reporting and fear of disqualification are common reasons for underreporting, which limits effective diagnosis and intervention [2,4].

Training staff and coaches must also be empowered to recognize red flags and remove fighters from play when needed.

Policy recommendations

Recommendations proposed across multiple studies include:

- Mandatory annual dilated eye exams
- Pre-bout ophthalmologic clearance for fighters with prior eye surgery or chronic conditions
- No competition for monocular athletes
- Use of eye shields or stopping bouts after significant

trauma [3,4,5,9]

Ringside physicians must also be equipped with the proper tools (e.g., fluorescein, Snellen charts, ophthalmoscopes) and protocols to screen for injuries [4].

Policy Gaps

Few high-quality studies evaluate the efficacy of protective strategies over time. Most recommendations stem from retrospective analyses, anecdotal reports, or expert consensus.

No standardized international guidelines exist for ocular injury prevention in combat sports, suggesting an urgent need for longitudinal research and cross-organizational consensus building.

Discussion

The findings of this review emphasize the critical need to reframe how ocular trauma is addressed in combat sports. While anterior segment injuries remain the most frequently observed, the risk of subtle posterior injuries — such as peripheral retinal degeneration, lens subluxation, and early glaucomatous changes — is often underestimated, particularly due to their asymptomatic nature.

This is concerning given the irreversible visual sequelae described in amateur athletes who lack access to regular ophthalmologic oversight.

A striking observation from the literature is the lack of standardized diagnostic and treatment protocols, especially in acute competition settings. Most existing data are derived from ringside assessments or retrospective injury databases, with limited specialist input. Consequently, the true burden of ocular trauma may be underreported, and current injury prevalence rates likely underestimate the actual risk.

These inconsistencies highlight the need for standardized clinical care pathways. Settings where immediate ophthalmologic referral is not feasible — such as during live events — would benefit from structured acute care protocols for non-specialist providers. While existing recommendations suggest basic screening tools (e.g., fluorescein staining, Snellen charts, and pupil assessments), the inclusion of ophthalmologists as part of ringside medical teams should be considered, especially in larger events sanctioned by national or international bodies. Such measures could enhance the legitimacy of event organization and significantly improve athlete safety.

Furthermore, the extent of underreporting remains unclear, as athletes may intentionally conceal symptoms to avoid disqualification or forced rest periods. To better understand this hidden burden, future studies could employ anonymous questionnaire-based designs, targeting athletes

across various combat disciplines. Data could explore the prevalence of unreported injuries, patterns of symptom management, injury severity, and treatment-seeking behavior — offering insights critical for policy development and athlete education.

Ultimately, ocular trauma in combat sports is not only a clinical and athletic concern but a regulatory and public health issue. Establishing prospective injury registries, formalized diagnostic protocols, and clearer return-to-play criteria — all adapted to the demands of combat sports — should be key priorities for governing bodies and healthcare professionals alike.

Conclusion

1. Ocular trauma in combat sports represents a significant, yet often underestimated, threat to athlete health and career longevity. This review demonstrates that anterior segment injuries—such as corneal abrasions and eyelid lacerations—are the most frequently reported, but posterior segment pathology, including retinal tears and vitreous changes, remains underrecognized and underreported. Combat sports like MMA pose a greater diversity and severity of injury risk compared to boxing, largely due to equipment differences and expanded strike mechanisms.

2. Despite the volume of athletes affected globally, standardized protocols for assessment, referral, and return-to-play remain inconsistent across regions and disciplines. In high-level settings, the integration of ophthalmologic screening and collaboration with multidisciplinary medical teams should become standard practice. Increased awareness, tailored protective strategies, and sport-specific clinical guidelines are urgently needed to safeguard long-term visual outcomes in combat athletes.

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**AKIŲ TRAUMOS KOVINIAME SPORTE:
MECHANIZMŲ, DIAGNOSTIKOS IŠŠŪKIŲ IR
PREVENCIŲ PRIEMONIŲ ANALIZĖ (2015–2025)**

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Raktažodžiai: akių traumos, kovinis sportas, akių sužalojimai, diagnostika, prevencija, tinklainės atsisluoksniavimas, lęšiuko poslinkis.

Santrauka

Akių traumos yra svarbi kovinio sporto problema, nes stiprūs smūgiai dažnai sukelia pažeidimus, kurių sunkumas svyruoja nuo lengvų paviršinių sužalojimų iki regėjimui grėsmingų priekinio ir užpakalinio segmento traumų. Ši naratyvinė apžvalga analizuoja akių traumų mechanizmus bokse, mišriuose kovos menuose, kinkbokse ir kitose kovinio sporto šakose, pabrėždama jėgas ir situacijas, lemiančias vokų plyšimą, hifemą, orbitos lūžius, lęšiuko pasislinkimą, stiklakūnio kraujavimą, tinklainės plyšimą ir atšokimą. Diagnostiką dažnai sunkina periorbitalinis tinimas, skausmas ir drumstos akies terpės, dėl kurių vėluojama nustatyti užpakalinio segmento pažeidimus, tačiau akies ultragarsas, kompiuterinė tomografija ir optinė koherentinė tomografija pagerina ankstyvą diagnostiką ir gydymo planavimą. Apžvalgoje taip pat aptariamos moksliškai pagrįstos prevencijos priemonės, tokios kaip tinkama apsauginė įranga, saugos taisyklių laikymasis, medicininė patikra ir operatyvus medicinos personalo įvertinimas, padedančios sumažinti sunkių akių traumų riziką. Geresnis traumų mechanizmų, diagnostinių ribotumų ir prevencijos strategijų supratimas yra būtinas siekiant mažinti akių sužalojimų dažnį ir sunkumą kovinio sporto šakose.

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Gauta 2026-01-27