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# Evaluating Eye Injuries from Traffic Accidents in Turkey: American Medical Association Guideline vs. National Regulations

## Türkiye'de Trafik Kazalarından Kaynaklanan Göz Yaralanmalarının Değerlendirilmesi: Amerikan Tıp Birliği Kılavuzu ile Ulusal Yönetmeliklerin Karşılaştırılması

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## ABSTRACT

**Objective:** Eye injuries have a significant effect, causing vision loss and an increase in the prevalence of visual impairment on a global scale. Traffic accidents are increasingly responsible for eye injuries, especially in developing countries. Traffic accidents cause people to suffer physical and/or psychological damage every year in our country and around the world. Through the analysis of impairment rates, this research aims to identify the strengths and weaknesses of the impairment assessment criteria.

**Methods:** Patients who applied to Mersin University Faculty of Medicine Forensic Medicine Department Impariment Polyclinic between January 1, 2015, and January 1, 2022 with eye injuries connected to traffic accidents had their sociodemographic and accident-related data scanned. Impairment rates were calculated individually for each case in accordance with the American Medical Association Guides to the Evaluation of Permanent Impairment (AMA guideline), the Regulation on Disability Assessment for Adults (Disability regulation), and The Regulation on Determination of Working Power and Loss of Profitability in Occupations [Social Security Institution (SSI) regulation].

**Results:** In our study, 67.1% of the 82 cases were male, with a mean age of 36.01. The cases exhibited the most common occurrences of corneal and nerve injuries. We observed a statistically significant difference in the medians of impairment rates calculated according to the AMA guidelines and the Disability and SSI regulations.

**Conclusion:** The calculation of impairment rates based on the SSI regulation for eye injuries revealed a constrained methodology, resulting in higher impairment rates compared to those determined by the AMA guideline and the Disability regulation. The Disability regulation and AMA guidelines were found to follow similar and detailed calculation methodologies. Within our country, we advocate for the adoption of a comprehensive guideline devoid of subjective interpretation for the determination of impairment rates in eye injuries resulting from traffic accidents, encompassing all conceivable eye-related diagnoses.

**Keywords:** Impairment, traffic accident, eye injuries, AMA guideline

***This article is derived from the thesis titled "Evaluation of Traffic Accidental Eye Injuries According to National and International Impairment Guidelines" authored by Abdullah Turan, which was conducted as a part of the Specialization in Forensic Medicine program at Mersin University.**

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## ÖZ

**Amaç:** Göz yaralanmaları, görme kaybına ve dünya çapında sıklığı giderek artan bir şekilde görme bozukluğuna yol açan önemli bir etkiye sahiptir. Göz yaralanmalarının meydana geliş şekli özellikle gelişmekte olan ülkelerde sıklığı giderek artan bir şekilde trafik kazalarıdır. Ülkemizde ve dünyada her yıl trafik kazası nedeniyle bireyler fiziksel ve/veya ruhsal hasara uğramaktadır. Bu çalışmamızda hesaplanan engel oranları üzerinden engellilik değerlendirme kriterlerinin zayıf ve kuvvetli yönlerinin belirlenmesi amaçlanmaktadır.

**Yöntem:** Mersin Üniversitesi Adli Tıp Anabilim Dalı maluliyet polikliniğine 01.01.2015-01.01.2022 tarihleri arasında trafik kazasına bağlı göz travması yaralanması ile başvuran hastalar sosyodemografik ve kaza ile ilgili verileri tarandı. Her olgunun ayrı ayrı Çalışma Gücü ve Meslekte Kazanma Gücü Kaybı Oranı Tespit İşlemleri Yönetmeliği [Sosyal Güvenlik Kurumu (SGK) yönetmeliği], Erişkinler için Engellilik Değerlendirmesi Hakkında Yönetmelik (Engellilik yönetmeliği) ve Amerikan Tıp Birliğinin düzenlediği Kalıcı Engellilik Değerlendirme Kılavuzuna (AMA kılavuzu) göre engel oranları hesaplandı.

**Bulgular:** Çalışmamızda değerlendirilen 82 olgunun %67,1'i erkek, ortalama yaşın 36,01 olduğu ve olgularda en sık kornea ve sinir yaralanması gözlendiği saptandı. AMA kılavuzu ile Engellilik ve SGK yönetmeliklerine göre hesaplanan engel oranların medyanları arasında istatistiksel olarak anlamlı farklılık saptandı.

**Sonuç:** SGK yönetmeliğinde göz yaralanmalarına bağlı engel oranı hesaplanmasında kısıtlı bir yaklaşım olduğu, engel oranlarının Engellik yönetmeliğine ve AMA kılavuzuna göre yüksek hesaplandığı görüldü. Engellilik yönetmeliğinin ve AMA kılavuzunun benzer ve ayrıntılı hesaplama yöntemleri kullandığı saptandı. Ülkemizde trafik kazasına bağlı göz yaralanmalarının engel oranı hesaplamalarında göze ilişkin tüm tanıları içeren, takdire yer bırakmayan ve kapsayıcı tek bir yönetmelik kullanması gerektiğini düşünmekteyiz.


**Anahtar Kelimeler:** Maluliyet, trafik kazası, göz yaralanmaları, AMA kılavuzu

## INTRODUCTION

Traffic accidents are an important problem all over the world due to their frequency, preventability, injuries, loss of function, deaths, and economic losses. According to the World Health Organization's global status report on road safety published in 2023, an estimated 1.19 million people die globally each year as a result of traffic accidents, and it is the top cause of death for children and young adults aged 5 to 29 years (1). In 2022, Turkey experienced 1.23 million road accidents, among which 1.03 million resulted in property damage, while 197 thousand led to fatal injuries (2).

Eye injuries are among the leading causes of vision loss and impairment (3). Worldwide, 19 million people have monocular blindness or impaired vision as a result of trauma. In the United States, an estimated 2-2.4 million cases of ocular trauma are documented each year, the majority of which result in permanent vision loss (4,5). Occupational injuries are the most common cause of ocular traumas, but traffic accidents are also becoming more common, especially in developing countries (6). Ocular traumas that cause socioeconomic, medical, and functional consequences to society and the patient, especially those caused by traffic accidents, should be considered since they are preventable (7).

The concept of impairment has been defined by the World Health Organization as "any loss or abnormality of psychological, physiological, or anatomical structure or function" (8). Evaluation of a person's impairment status following a traffic accident, documentation, and reporting of the health condition all play a significant role in forensic medicine practices. In Turkey, forensic medicine specialists determine impairment rates for disability conditions resulting from traffic accidents and for person's compensation claims and they provide reports to courts via attorneys, insurance companies, or individual applications.

While the regulations applied to impairment calculations in Turkey are primarily based on the date of the accident, the courts have the authority to change the regulations to be applied in particular cases in accordance with the demands of the insurance company, judicial rulings, and legal justifications (9,10). The Regulation on Determination of Working Power and Loss of Profitability in Occupations [Social Security Institution (SSI) regulation] and the Regulation on Disability Assessment for Adults (Disability regulation) are the most actively used at the moment.

The "American Medical Association Guides to the Evaluation of Permanent Impairment" which is currently used by many countries in the world, was first published in 1958 as an article in the Journal of the American Medical Association with the name "A Guide to the Evaluation of Permanent Impairment of the Extremities and Back" (11). Later, in 1971, the first edition of the guide, consisting of 13 chapters, was published, and it was constantly updated in light of current scientific knowledge and experience, resulting in the publication of the third edition in 1988, the fourth edition in 1993, the fifth edition in 2000, and the sixth edition in 2008. The sixth edition is revised in 2021 and 2022, and the guide is kept up to date (12).

The Visual System is covered in Chapter 12 of the American Medical Association Guides to the Evaluation of Permanent Impairment (AMA guideline). This chapter provides criteria for evaluating permanent visual system impairment, which indicates how much the individual's ability to perform visual activities in daily life is affected. Since the visual system is a

system that combines input from two separate eyes in a single visual perception, calculations are made in accordance with the International Classification of Impairments, Disabilities and Handicaps and International Classification Functioning, Disability and Health principles, not by considering the anatomical changes in any component of the visual system on their own, but only by considering their functional results (12). Visual acuity and visual field are used as key factors when evaluating impairment. Following an eye examination to determine whether the current findings are consistent with the complaints and whether the person has reached the maximum medical improvement (completion of recovery), functional scores are calculated using the relevant tables and formulas, and the visual system impairment rate and, ultimately, the whole-person impairment rate are determined based on these scores.

According to the SSI regulation, the degree of impairment listed is determined based on the individual's disability, while the decrease in the person's earning capacity within their profession is ascertained by arranging tables according to the person's age and profession.

The Disability regulation, like the AMA guideline, bases visual acuity and visual field on the calculation of visual system impairment. Following the determination of monocular and binocular visual acuity and visual fields, functional scores are calculated using the relevant tables and formulas, and the person's permanent impairment rate is calculated using these scores.

The objective of this study is to calculate the impairment ratios based on regulations in Turkey and the AMA Guideline, compare the calculated rates, investigate the reasons for the differences, and evaluate the used regulations and guidelines in terms of their strengths and weaknesses, using cases of patients who presented to our polyclinic with eye injuries after a traffic accident.

## MATERIALS AND METHODS

### Study Design

Between January 1, 2015, and January 1, 2022, a retrospective analysis was conducted at the Impairment Polyclinic of the Department of Forensic Medicine at Mersin University Faculty of Medicine. Out of the total 1080 cases submitted during this period, 82 cases (7.6%) that had completed recovery and were associated with eye trauma resulting from traffic accidents were included in the study. The patients medical records were reviewed, their complaints were evaluated, a physical examination of their current state was performed, and the results were documented in our polyclinic.

### Sampling

The medical records of patients who were diagnosed with ocular injuries as a result of a traffic accident at our polyclinic and whose recovery was complete were checked, their complaints were analyzed, and a physical examination of their present condition was done and the results were documented.

### Data Collection

By examining the accident detection reports, the way the traffic accident occurred and the date of the accident were determined. After our evaluation of the patient was complete, we consulted with the department of ophthalmology and other relevant branches. A report document outlining the impairment rate was prepared for the cases that were found to have reached the maximum level of medical improvement as a result of the tests and clinical branch evaluations. The prepared reports were assessed considering the following criteria: gender, age, accident and report dates, type of eye trauma, unilateral or bilateral nature, surgical intervention, presence of an isolated eye injury, pre-existing eye conditions, concurrent injuries, visual acuity, and visual field test results. Impairment rates were computed according to the Disability and SSI regulations and the AMA guidelines.

The occupation was not taken into consideration while calculating the impairment rate in accordance with the SSI regulation, and in every case, the calculation was conducted as for a regular worker. Since a value between 0.1 and 0 for visual acuity is not specified in the lists in the SSI regulation, the calculation was made by accepting the visual acuity as 0 in cases with visual acuity below 0.1.

The visual acuity degrees in the AMA guidelines are listed in US notation and 1 m notation; decimal visual acuity is not included. Therefore, in cases with visual acuity of 0.9 (20/22.2), 0.7 (20/28.5), 0.6 (20/33.3), and 0.3 (20/66.6), the calculation was made by rounding to the nearest degree of low visual acuity.

In cases with vision loss before the traffic accident, the difference between the person's impairment rate before and after the accident was accepted as the person's accident-related impairment rate.

### Statistical Analysis

The normal distribution control of continuous data was done with the Shapiro-Wilk test. The median, first and third quartiles, minimum and maximum values are used to summarize variables that do not have a normal distribution. For categorical variables, numbers and percentages from descriptive statistics were used.

Impairment rates and mean ages of two independent groups were compared with the Student's t-test, which is one of the

parametric tests, and the medians of impairment rates with the Mann-Whitney U test, which is a non-parametric test.

The Friedman test, one of the non-parametric tests, was used to determine the differences between the impairment rates. Paired comparisons were made to determine the groups that differed as a result of this test, and a post-hoc test with Bonferroni correction was used.

A correlation analysis was performed to investigate the relationship between impairment rates and age, and the Sperman correlation coefficient was used. A statistical significance level (p) of 0.05 was taken in all comparisons.

## RESULTS

Of 82 cases, 67.1% (n=55) were male and 32.9% (n=27) were female. The mean age was 36.01±17.04 (minimum: 14; maximum: 82) in the general population, and the age distribution was 62.2% (n=51); 21-50 was found to be concentrated. It was determined that 48.8% (n=40) of the accidents occurred as in-vehicle traffic accidents, 30.5% (n=25) accidents involved motorcycles and bicycles, and 20.7% (n=17) were pedestrian traffic accidents (Figure 1).

All cases were found to have had head trauma; 96.3% (n=79) of these cases also had ocular trauma, 71.9% (n=59) skull fractures, and 53.7% (n=44) intracranial injuries. In addition, 25.6% (n=21) extremity injuries, 19.5% (n=16) chest injuries, 10.9% (n=9) spine injuries, 8.5% (n=7) pelvis injuries, and 6.1% (n=5) abdominal injuries were found in the cases.

When we look at the time elapsed between the date of the accident and the date of the report, it was found that the application period extended up to 8 years after the traffic accident, and 74.3% (n=61) of the cases applied to our polyclinic within two years of the date of the accident.

Examining eye injuries, we discover that 20.7% (n=17) cases had bilateral eye injuries, 79.3% (n=65) cases had unilateral eye injuries, and 30.5% (n=25) cases had isolated eye injuries (Table 1).

It was found that 3.7% (n=3) of the cases had visual field loss, and these were bitemporal hemianopsia, macular preserved left hemianopsia, and right anopia.

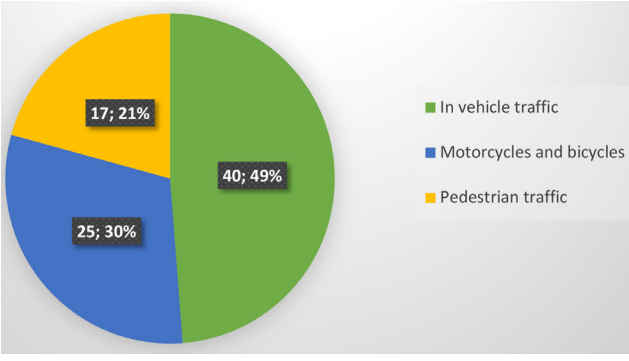


Figure 1. Accident type

When we examine the areas where eye injury was found after the recovery process was complete, 18.3% (n=15) corneal injury, 18.3% (n=15) nerve injury, 8.5% (n=7) retinal injury, vascular injury in 3 cases, ptosis in 3 cases, lacrimal duct occlusions in 2 cases, ectropion in 1 case, diplopia in 1 case, evisceration in 1 case, and 41.5% (n=34) cases healed without sequelae (Table 1).

It was found that 82.9% (n=68) of the cases were followed up non-operatively, 17.1% (n=14) were operated on after the traffic accident (Table 1), and none of them developed complications.

When we looked at the eye examination findings after the healing was complete, the visual acuity values in the right eye were 0.8±0.37, the visual acuity values in the left eye were 0.7±0.4, and the binocular visual acuity values were 0.88±0.2.

As a result of the examinations and tests performed in our study, when we look at the impairment rates calculated according to the SSI, Disability regulation, and AMA Guideline, the lowest rate was "0% (zero percent)" in all three, the highest rate calculated according to the SSI regulation was 100%, the Disability regulation was 90.0%, and the AMA guideline was 85.0%. When the median impairment rates of the regulations and the AMA guideline were compared, it was found that there was a statistically significant difference between them ($p<0.0001$).

Pairwise comparison of the calculated impairment ratios is given in Table 2. It was found that impairment rates calculated according to the SSI regulation were higher than the Disability regulation and AMA guideline; there was a statistically significant difference between the SSI regulation and the Disability regulation ($p=0.001$), and similarly, there was a

**Table 1. Eye injury findings**

| Findings | | n (%) |
|---|---|---|
| Type of eye injury | Unilateral | 65 (79.3) |
| | Bilateral | 17 (20.7) |
| Operation | Operation required | 14 (17.1) |
| | Non-operation | 68 (82.9) |
| Isolated eye injury | | 25 (30.5) |
| After healing, the eye damaged area | Cornea | 15 (18.3) |
| | Nerve damage | 15 (18.3) |
| | Retina | 7 (8.5) |
| | Vascular damage | 3 (3.7) |
| | Visual field loss | 3 (3.7) |
| | Ptosis | 3 (3.7) |
| | Lacrimal canal obstruction | 2 (2.4) |
| | Ectropion | 1 (1.2) |
| | Diplopia | 1 (1.2) |
| | Evisceration | 1 (1.2) |
| | Complete recovery | 34 (41.5) |

statistically significant difference between the SSI regulation and the AMA guideline (p<0.0001). However, no statistically significant difference was found between Disability regulation and AMA guideline impairment rates (p=0.593).

When we look at the correlation between the age of the cases and the calculated impairment rates (Table 3), a statistically significant but very weak correlation is found between impairment rates calculated according to SSI regulation (r=0.235) and AMA guidelines (r=0.235) and age (p=0.034). There was no statistically significant correlation between impairment rates calculated according to the Disability regulation (r=0.210) and age (p=0.059).

According to whether the injury is unilateral or bilateral, we compared the median impairment rates calculated by SSI regulation, Disability regulation, and AMA guidelines and found a statistically significant difference between the three of them (p<0.0001) (Table 4). It was found that cases with bilateral injuries had a higher median impairment rate.

According to whether or not they had undergone surgery following an accident, we compared the median impairment rates calculated by SSI regulation, Disability regulation, and AMA guidelines and found a statistically significant difference between the three of them (p=0.001) (Table 5). The median impairment rate of the operated cases was found to be higher than the non-operated cases.

## DISCUSSION

In order to determine the disability status of people with eye injuries due to traffic accidents, impairment ratio calculation is required.

When we look at the studies on disability in Turkey, Birgen et al. (13) reported that 11 (5.78%) of 139 cases detected defects in the eye region, Esiyok et al. (14) reported that eye injuries were detected in 18 (6.1%) of 563 cases, Kaya et al. (15) reported that eye injuries were detected in 15 (4.1%) of 319 cases, In Gürbüz's thesis study (16), eye injuries were detected in 30 (4.1%) of 908 cases, in the study performed by Ünal et al. (17), disability was determined based on the difference in the impairment ratio before and after the accident, visual impairment was detected in 9 of 16 cases, and Eroğlu's thesis study (18) showed that 6 (6.4%) of 78 cases had eye injuries.

**Table 2. Pairwise comparison of calculated impairment rates**

| Regulations and AMA guidelines | | n (%) | p |
|---|---|---|---|
| Disability-SSI | Disability < SSI | 42 (51.2) | 0.001 |
| | Disability > SSI | 5 (6.1) | |
| | Disability = SSI | 35 (42.7) | |
| AMA-SSI | AMA < SSI | 43 (52.49) | <0.0001 |
| | AMA > SSI | 5 (6.1) | |
| | AMA = SSI | 34 (41.5) | |
| AMA-Disability | AMA < Disability | 23 (28) | 0.593 |
| | AMA > Disability | 7 (8.5) | |
| | AMA = Disability | 52 (63.5) | |

AMA: American Medical Association Guides to the Evaluation of Permanent Impairment, SSI: Social Security Institution

**Table 3. Correlation relationship between age and impairment rates**

| Regulations and AMA guidelines | p | Correlation coefficient (r) |
|---|---|---|
| SSI | 0.034* | 0.235* |
| Disability | 0.059 | 0.210 |
| AMA | 0.034* | 0.235* |

*: Satistically significant, AMA: American Medical Association Guides to the Evaluation of Permanent Impairment, SSI: Social Security Institution

**Table 4. Comparison of impairment rates according to type of eye injuries**

| Regulations and AMA guidelines | Unilateral (n=65) | | Bilateral (n=17) | | |
|---|---|---|---|---|---|
| | Min-Max (%) | Median [Q1-Q3] | Min-Max (%) | Median [Q1-Q3] | p |
| SSI | 0-58 | 0 [0-32.3] | 0-100 | 48 [20-60] | <0.0001 |
| Disability | 0-58 | 0 [0-32] | 0-90 | 30 [6-43.5] | <0.0001 |
| AMA | 0-65 | 0 [0-20] | 0-85 | 28 [6-38] | <0.0001 |

Min: Minimum, Max: Maximum, AMA: American Medical Association Guides to the Evaluation of Permanent Impairment, SSI: Social Security Institution

**Table 5. Comparison of impairment rates by operation**

| Regulations and AMA guidelines | Operation required (n=14) | | Non-operation (n=68) | | |
|---|---|---|---|---|---|
| | Min-Max (%) | Median [Q1-Q3] | Min-Max (%) | Median [Q1-Q3] | p |
| SSI | 0-100 | 36.5 [24-49.4] | 0-100 | 0 [0-33.5] | 0.001 |
| Disability | 0-90 | 32 [5.5-38.7] | 0-70 | 1 [0-31.5] | 0.001 |
| AMA | 0-85 | 20 [5.5-36] | 0-80 | 1 [0-20] | 0.001 |

Min: Minimum, Max: Maximum, AMA: American Medical Association Guides to the Evaluation of Permanent Impairment, SSI: Social Security Institution

Worldwide, it has been estimated that there are around 55 million eye injuries per year; 1.6 million of these injuries cause total blindness, 2.2 million cause bilateral vision loss, and 19 million cause unilateral blindness or vision loss (4). In studies on eye injuries due to traffic accidents, Sastry et al. (19) reported that 52% of the cases with ocular trauma occurred due to traffic accidents, Guly et al. (20) reported that 57.3% of ocular injuries occurred due to traffic accidents, Park et al. (21) reported that 56.7% of the cases with ocular trauma were injured due to traffic accidents and in an epidemiological study by Acar et al. (22), it is stated that 20.8% of traumatic eye injuries occur due to traffic accidents, with the second highest frequency. In the event that ocular trauma occurs due to a work accident or traffic accident, disability status should be determined for compensation claims. According to studies, eye injuries caused by traffic accidents are becoming increasingly common. For this reason, it's critical to conduct a thorough and in-depth examination and to prepare a impairment report using a multidisciplinary approach, especially when evaluating these cases.

In the gender distribution of studies conducted in Turkey to determine the impairment ratio, the male gender is dominant at rates ranging from 69.9% to 81.9% (15,16,18,23), and in international studies on eye injury, the male gender is dominant at rates ranging from 81.0% to 83.5% (24,25). In our study, findings revealed that the gender distribution of eye injury cases aligns with existing literature trends, indicating a predominance of males. We believe that this is because men participate more actively in economic life in many nations, including Turkey. According to Turkish Statistical Institute 2020 data on having a driver's license by gender, it is stated that men are in the majority, with 73.2%, and 2020 Highway Traffic Accident Statistics, 70.5% of those injured in traffic accidents are male (2,26). When we take into account the fact that all injuries in our study are caused by traffic accidents, it becomes clear that men are more likely to be involved in accidents and constitute the majority of applications for disability reports. In our study, the age distribution was notably concentrated between 21-50 years old, comprising 62.2% (n=51) of the total cases, indicating a focus within the working-age population. Additionally, no statistically significant difference was found between age groups and gender. It is found that the age distribution is particularly concentrated in the working-age population. In Turkey, the age limit for obtaining a driver's license is 18, and we believe that injuries occur most frequently in this age range due to factors such as the active working population being the main users of traffic and the possibility of younger population being more careless in traffic and not taking protective measures such as seat belts.

When examining the time elapsed between the accident date and the report preparation date, it was determined that the application period extended up to 8 years after the traffic accident, and a majority of cases applied to our clinic within two years after the accident date. When looking at the studies conducted in our country, it is observed that the application period can extend up to 12-16 years (15,27), and there is a variation in the range of 40.2% to 85.8% for applications within the first 2 years (15,16,28). For impairment evaluation, it is required that the individual has reached the maximum medical improvement stage, meaning that the recovery process has been completed. In the reports prepared by our department, disability assessment is conducted after the completion of the recovery period, in line with the literature. Therefore, in our study, it was determined that the period between the accident date and the report date is predominantly concentrated within 1-2 years, consistent with the literature.

When examining the literature regarding accompanying injuries in eye trauma, Goyal et al. (29) found that skull fractures were detected in 22.6% of cases with ocular trauma related to traffic accidents, while extremity fractures were found in 18.2% of cases, and multiple injuries in more than one region were observed in 84.4% of cases. In a study conducted by Tielsch et al. (7), it was reported that 74.2% of cases with ocular trauma had multiple injuries in different regions, and skull fractures or intracranial injuries were detected in 41.3% of cases. According to the study by Park et al. (21), at least one fracture was found in 73.6% of cases, with skull fractures identified in 24% of cases, and brain hemorrhage detected in 40.9% of cases. In our study, we found that all cases of eye injuries resulting from traffic accidents were accompanied by head trauma. Moreover, a significant number of cases also exhibited skull fractures, intracranial injuries, and extremity injuries. These findings highlight the severity of trauma associated with traffic accidents, emphasizing the potential impact of factors such as seat belt usage. The positioning of individuals and vehicles, along with the deployment of safety measures like airbags, also contribute to the severity of trauma in such accidents. Studies have consistently demonstrated that wearing a seat belt reduces the risk of injuries (30,31). However, our study revealed a higher incidence of accompanying skull fractures and intracranial injuries, suggesting that the lower prevalence of seat belt usage in our country may contribute to increased trauma severity.

The results of our study demonstrate significant differences in impairment rate calculations between SSI regulation, Disability regulation, and AMA guidelines. Notably, we found a statistically significant difference in the median impairment rates that resulted from these frameworks, which suggests that there are subtle variations in how they are applied.

We have identified cases where the SSI regulations resulted in higher impairment rates compared to Disability regulations and AMA guidelines, particularly noticeable when visual acuity

fell within specific thresholds. In the study conducted by Doğan Temiz et al. (32) on the evaluation of disabilities due to eye impairments, it was reported that in 455 cases (76.9%), the SSI regulation impairment rate was higher than the Disability regulation impairment rate, in 38 cases (6.4%), the Disability regulation impairment rate was higher than the SSI regulation disability rate, and in 99 cases (16.7%), there was no impairment rate specified.

While Disability regulations and AMA guidelines share similar methodologies in calculating impairment rates, there are still differences in how certain cases are evaluated between these two guidelines. Moreover, the differences in calculating impairment rates highlight the possibility of disparities in the rights and entitlements of individuals evaluated under different regulatory frameworks. Relying solely on medical judgment within the scope of SSI regulations raises concerns regarding consistency and standardization, potentially impacting individuals' access to necessary support and resources.

Upon examination of the reasons behind these discrepancies, it's apparent that visual acuity values are presented differently in the AMA guidelines, utilizing both US notation and 1 m notation. Consequently, visual acuity scores such as 0.9, 0.7, 0.6, and 0.3 are not explicitly specified. As a result, in cases where impairment assessment is necessary for these visual acuity degrees, calculations were performed by rounding to the nearest lower visual acuity level.

In the AMA guidelines, when the visual system impairment rating exceeds 50, the formula "Whole Person Impairment = 50 + 0.7 x (Visual System Impairment – 50)" is employed to determine the impairment rating of the whole person. However, in Disability regulations, a slightly different formula is utilized: "Whole Person Impairment = 50 + 0.8 x (Visual System Impairment – 50)" when the visual system impairment rating exceeds 50.

Diverse approaches are noted in cases of monocular blindness evaluation. In the Disability regulations, it's acknowledged that the eye with complete vision loss also experiences visual field loss, leading to a calculated impairment rate of 32.0%. Conversely, the AMA guideline does not include visual field loss detected in the eye with complete visual loss in the calculation, resulting in a 20.0% impairment rate. Considering the impact on depth perception in cases of monocular blindness (33), we suggest that the Disability regulations offer a more accurate method for evaluating these scenarios by incorporating visual field loss in the affected eye.

It is seen that the Disability regulation and AMA guideline have a similar approach to calculating the impairment rate for visual field loss, but there is a limited approach to visual field loss in the SSI regulation. Hemianopsies and peripheral visual field loss are included in the SSI regulation; peripheral visual field loss is divided into 10° and 30°; and central visual field loss, which is more important than peripheral visual field loss, is not included in the lists. For this reason, we think that medical judgment is used when preparing reports according to SSI regulations in cases with visual field loss; it is not a standard approach, and this situation may lead to a loss of rights.

Overall, it's imperative to address these discrepancies and inconsistencies in impairment rate calculations across regulatory frameworks to ensure equitable treatment and support for individuals with visual impairments. Standardizing methodologies, particularly by adopting comprehensive approaches similar to Disability regulations, can promote accuracy and fairness in impairment evaluations.

A statistically significant but very slight association was found between age and impairment rates calculated in accordance with SSI regulations and AMA guidelines ($p=0.034$) when we looked at the correlation between the age of the patients and the estimated impairment rates (Table 3). In the Disability regulation, there was no statistically significant correlation between the calculated disability rates and age. While calculating according to the SSI regulations, it is seen that age has positive and negative effects on the impairment rate according to the E chart. However, we think that there is no correlation with the socioeconomic losses of the people involved in active working life and that the fact that individuals with the same injury are given very different disability rates due to age differences causes inequalities. In the AMA guideline, the calculations were created to include variables correlated with age based on how much the individual restricts his daily life activities. Age is also not included in the calculation as a factor increasing the impairment rate; the effect of age is included in all steps of the impairment rate calculation, and therefore more scientifically accurate results can be obtained.

When we compare the impairment rates calculated according to whether the injury is unilateral or bilateral (Table 4), the medians of impairment rates in all calculations show statistically significant differences ($p<0.0001$). The vision system works as a unique system that combines the input from two separate eyes into a single visual perception, and in the case of vision loss in one eye, the impairment rate is calculated by considering the remaining vision in the other eye. When we look at the Disability regulation and AMA guideline principles, it is seen that the impairment ratio is calculated higher for bilateral vision losses due to bilateral eye injuries since binocular vision has a superior share of 60%.

We compared the cases according to whether an operation was performed following the accident (Table 5), and we discovered a statistically significant difference between the median impairment rates across all calculations ($p=0.001$). We think that this is because traumas requiring surgical intervention typically involve high-energy injuries (24), particularly penetrating eye injuries, which require surgery and result in more severe vision loss (34).

When the literature in our country is reviewed, it is observed that there are limited studies comparing impairment assessments, including SSI regulations, Disability regulations, and AMA guidelines (23,27,28,35). Although these studies do not specifically address impairment assessments for eye injuries, it is noted that different calculation criteria arise from regulations in impairment assessments, and the SSI regulation is frequently considered insufficient in these evaluations.

We think that the AMA guideline and Disability regulation take into careful consideration the calculations involved in evaluating impairments caused by eye injuries. These frameworks are considered appropriate for use because they cover potential eye injuries and offer thorough explanations of every step involved. However, in practice, disparities still exist despite their comprehensiveness, in part because SSI regulations are still in place. As a result, it is thought that impairment assessments should be conducted according to a single, all-encompassing rule that does not allow for any latitude, guaranteeing consistency in assessments.

## CONCLUSION

1. In the AMA guideline and the Disability regulation, impairment rates in eye injuries are calculated using similar formulas based on visual acuity and visual field loss. However, in the SSI regulation, impairment is assessed based on predefined values listed within the regulation, which can be restrictive and insufficient in practice due to the absence of certain limitations. Therefore, there is a need for revision to address these limitations.

2. Monocular blindness presents a discrepancy in approach between the AMA guideline and the Disability regulation. While the AMA guideline excludes visual field loss in cases of monocular blindness, the Disability regulation adopts a more accurate approach by incorporating visual field loss in the calculation.

3. It is important that the reports requested after the injuries be used to compensate for the loss of rights; therefore, it is crucial for the professionals doing this job to make a detailed evaluation in these cases and to access the visual examination records of the person before the event, if any, in order to establish the accidental causation of the injury.

4. It is necessary to evaluate cases after maximum medical recovery occurs following medical and/or surgical treatments and follow-ups, to consider the possibility of simulation, and to carefully document visual acuity and visual field examinations in order to be able to assess impairment in eye injuries.

5. We advocate for the adoption of a comprehensive regulation encompassing all eye-related diagnoses in the impairment evaluation of eye injuries in Turkey. This unified approach would streamline the evaluation process and ensure consistency and fairness in assessing impairment in eye injuries.

## ETHICS

**Ethics Committee Approval:** An application was made to the Mersin University Rectorate Clinical Research Ethics Committee on December 17, 2021, regarding our study. Research permission was granted with the decision of the Mersin University Rectorate Clinical Research Ethics Committee, dated December 29, 2021, and numbered 2021/786.

### Authorship Contributions

Concept: A.T., N.G.B., H.K., Design: A.T., N.G.B., H.K., Data Collection or Processing: A.T., N.G.B., H.K., Analysis or Interpretation: A.T., N.G.B., H.K., Literature Search: A.T., N.G.B., H.K., Writing: A.T., N.G.B., H.K.

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