BALKAN ORL-HNS

The Evaluation of Hearing Results in Professional Referees

ORIGINAL ARTICLE
BALKAN ORL-HNS 2024;1(1):19-22

ABSTRACT

Background: Noise-induced hearing loss is the most common cause of hearing loss in the world and in our country. Today, high levels of sound are reached due to the factors present in the open and closed environments where sports events are held. In addition to these high levels, the referees in these environments are also exposed to whistle sounds that can reach 140 dB. In the literature, there is no study on the hearing levels of referees. In this study, the hearing results of the referees who were professionally refereed and who were exposed to high sound levels were evaluated.

Methods: The study included 50 referees who applied to our hospital between 2016 and 2017 and who had routine hearing evaluations. The control group included 49 volunteers who did not experience any noise exposure and had no previous hearing problems. The otoscopic examination, and pure-tone audiometry of the 2 groups were performed and the results were compared.

Results: At the end, 20 dB and over 4000 Hz frequencies were observed in any ear of 7 of the 50 referees. A statistically significant difference was found in the comparison with healthy individuals.

Conclusion: As a result, it was concluded that the arbitration profession could be a risky profession in terms of hearing loss.

Keywords: Referees, hearing loss, noise, football

Introduction

Noise-induced hearing loss (NIHL) is one of the most common causes of hearing loss (1). In the world and in Türkiye, one of the most commonly seen occupational diseases is the NIHL.[1,2] In the United States alone, there are 26 million people aged between 20 and 60 years with high frequencies of hearing loss due to exposure to loud tones and occupational noise.[1]

"Bel" is used as the unit of measurement of the noise intensity. In practice, however, the term decibel (dB), which is one-tenth of the bel value, is used as an international sound intensity unit. Decibel is used as the unit of evaluation for medium and high frequencies to which the human ear is most sensitive.[3] High levels of noise exposed to in sports environments and generated, especially by the viewers/audience, adversely affect the health of athletes, viewers, and referees both on psychological and physiological levels. As the intensity and density of the noise increases (above 85 decibels), hearing fatigue occurs and side effects such as buzzing and tinnitus may develop.[4]

Especially center referees, among other professional football referees, are exposed to the sound of the whistle in addition to the noise generated in their given sports environment. The mean number of games officiated by the 50 referees in our study was found to be 19.2 (range 12-24). These data were obtained through the Turkish Football Federation's official website, where the number of games officiated by the referees at the time of the test was

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Received: June 27, 2023
Accepted: October 5, 2023
Publication Date: January 31, 2024

Cite this article as: Celik S, Mehmet Hanege F. The evaluation of hearing results in professional referees. *Balkan ORL-HNS* 2024;1(1):19-22.

DOI: 10.5152/bohns.2024.23016

Table 1. Attributes of the 7 referees with Noise-Induced Hearing Loss

	Years in Profession	Officiating Position	Exposure to Loud Tone (Gunshot etc.)	Number of Games Officiated in the Last 1 Year	Tinnitus	4000 Hz Hearing Loss dB (Right, Left)
Referee 1	7	Assistant	None	16	None	35, 40
Referee 2	8	Center	None	18	None	60, 60
Referee 3	5	Assistant	None	19	None	60, 60
Referee 4	3	Center	None	18	None	60, 60
Referee 5	4	Center	None	22	None	30, 15
Referee 6	4	Assistant	None	16	None	30, 15
Referee 7	6	Center	None	20	None	40, 40

present. A referee whistle used as a standard may generate up to 140 dB of sound.[5] In the literature review, there are no studies investigating the effects of ambient noise to which football referees are exposed on their hearing levels. In this study, we aimed to determine if there are hearing losses that may occur after the cochlear injury caused by chronic exposure to noise focusing on the referees who have been professionally officiating for certain periods of time.

Material and Methods

This study protocol was approved by the local ethics committee. "Informed volunteer consent" was obtained from all referees who participated in the study. Registered professional referees who were under the Turkish Football Federation and who were admitted to our clinic for periodic examinations were evaluated for their hearing. A questionnaire was administered to 50 referees regarding their years of experience, health concerns, tinnitus, past exposure to gunshot noise or other loud sounds, and reported hearing difficulties. The survey aimed to gather objective data on these factors. Pure audiograms were applied to the patients by the same audiometrist following ENT examinations. In the volunteer group, pure-tone audiometry of 49 healthy individuals without any hearing complaints was carried out and the hearing results of these 2 groups were compared. In pure-tone audiometry, it was thought that the hearing levels were affected by the noise level of those with a loss of 20 dB above 4000 kHz.

When evaluating the findings obtained in this study, IBM Statistical Package for the Social Sciences Statistics 22 software for statistical analysis (IBM SPSS Corp.; Armonk, NY, USA) program was used. Fisher's exact chi-square test was performed to compare the data. The significance was evaluated at the level of $P < .05$.

Results

Of the 50 professional referees included in the study, 8 were female (16%) and 42 were male (84%). When the duty types of the referees were evaluated, 40.0% (n = 20) was the assistant referee and 60.0% (n = 30) was the center referee. The years in the profession ranged between 1 and 16 years, and the mean duration of work in the profession is calculated to be 6.30 ± 3.19 years. The mean age of the referees was found to be 27.7 (range 21-40 years). The mean years in the profession for referees was 6.3 years (range 1-16 years). All referees underwent routine otoscopic examination prior to pure-tone audiometry. Otoscopic examination of all referees participating in the study was normal.

The mean age of the 49 healthy volunteers included in the study was 29.5 (range 18-45), 44 of whom were male (89.7%) and 5 were female (12.3%). These individuals were those who were not chronically exposed to noise earlier, had no hearing loss known, and whose otoscopic examinations were normal.

In 7 of 50 referees whose pure-tone audiometry was performed, a hearing loss of 20 dB and above at 4000 Hz was detected at least in one of their ears. A statistically significant difference was found in the statistical analysis between the 2 groups in terms of hearing loss at 4000 Hz experienced by the referees ($P < .05$).

Four (57.1%) of these 7 referees were officiating as a center referee and the other 3 (42.9%) were assistant referees. The mean age of these 7 referees was calculated to be 31.2. Table 1 provides detailed information about the years spent by the referees in their profession, their positions, the loud tone they previously exposed to, the number of games they officiated in the last year, and the complaint of tinnitus. According to the positions of the referees in the football field, there was no statistically significant difference found in terms of the effect of the exposure at a measurement of 4000 Hz ($P > .05$). As for gender, there was no statistically significant difference found in terms of the effect of the exposure at a measurement of 4000 Hz ($P > .05$).

In the volunteer group participating in the study, there was no hearing loss of 20 dB or above observed at any frequency. Bilateral hearing levels were normal.

MAIN POINTS

- *Professional football referees carry a risk of noise-induced hearing loss.*
- *High levels of noise exposed to in sports environments and generated, especially by the viewers/audience, adversely affect the health of athletes, viewers, and referees both on psychological and physiological levels.*
- *As the intensity and density of the noise increases (above 85 dB), hearing fatigue occurs, and side effects such as buzzing and tinnitus may develop.*

Discussion

Noise-induced hearing loss is a hearing loss that develops as a result of intermittent or continuous exposure to noise. Hearing loss occurs in those with exposure to chronic noise, first at the level of 3000-6000 Hz over the years and mostly at the frequency level of 4000 Hz. If there is no additional age-related hearing loss, hearing threshold recovers at 8000hZ. However, the longer the exposure time, the greater the loss of hearing loss spread to other frequencies (higher levels at higher frequencies).[6-8] When age-related and other causes are excluded, the hearing loss is not expected to be above 40 dB HL at low frequencies and 60 dB HL at high frequencies.[9-11]

Today, NIHL is one of the most common occupational diseases in addition to being one of the most important causes of hearing loss in adults. Approximately 10% of the world's population complains of hearing loss, and severe noise exposure accounts for approximately 50% of these cases.[1]

According to the National Institute for Occupational Health and Safety, NIHL is a 100% preventable health problem. Once it occurs, however, it may cause irreversible problems.[12,13]

Nowadays, one of the branches of sport where the referees officiate and are exposed to noise is football. Referees are expected to exhibit high performance so as to be able to watch the game more closely, to have better control, and to keep up with the rising tempo of football.[14] It is thought that referees may suffer from hearing problems due to the loud tones of the whistles they are exposed to in addition to the sports environment they are in. This study was started with the thought that these exposures of the referees might affect their cochlear functions, and the damage was detected accordingly.

There is a very limited body of literature focusing on the effect of exposure to loud tones on referees who are either in the sports field for entertainment, sportive or spectatorship purposes and on who adopted this as their profession. Referees are exposed to noise levels caused by whistles up to 140 dB in addition to the sports environment they are bound to. In their study, Arslan et al[5] measured the noise levels in indoor and outdoor sports facilities. Measured noise levels were determined to be 70-120 dB in outdoor sports areas and 65-113 dB in indoor sports areas. As a result, they put forth that the measured noise levels exceed the normal levels and suggested that the referees and athletes working in the outdoor and indoor sports areas could experience irreversible hearing loss problems. In the literature, there are no studies on the hearing levels of the referees who are chronically exposed to noise.

In Engard's[15] study, the sound levels in the 3 major football stadiums and the rates of exposure effects were compared, and it was reported that individuals were exposed to sound intensity of 85 dB and above and that people working in these environments should take special precautions. In a study carried out by Hodgetts and Liu, the hearing levels of hockey players were evaluated. In this study, it was found that there were temporary hearing losses between 5 and 10 dB at the frequency of 4000 Hz by means of the pure tone audiometry performed after the game.[16] Adams and Brazile,[17] in their study, evaluated the hearing results of the people who were working during hockey games in the indoor hall and the tone intensity they were exposed to. They detected a loss of 15 dB or more at a frequency of 4000 Hz and reported that they were at risk for NIHL.

In 7 of 50 referees in our study, a hearing loss of 20 dB and above at 4000 Hz was detected at least in one of their ears. In the statistical comparison with the healthy volunteers, it was found to be significantly higher.

One of the limitations of our study is the inability to make comparisons with the past hearing tests of the referees, i.e., when they started their profession, since their prior results are not archived in our hospital. Another limitation of this study is that although the exposure of the patients to noise is questioned, NIHL may also develop due to various environmental factors. This study is a preliminary study on this subject, and a larger series of more extensive studies are indeed needed.

In conclusion, professional football referees carry a risk of NIHL, and accordingly, their annual hearing tests should be performed and certain precautions should be considered.

Ethics Committee Approval: *Ethics committee approval was received for this study from the ethics committee of Istanbul Medeniyet University on November 21, 2017 (approval number: 2017/0330).*

Informed Consent: *Informed consent was obtained from the patients who agreed to take part in the study.*

Peer-review: *Externally peer-reviewed.*

Author Contributions: *Concept – S.C., F.M.H.; Design – F.M.H.; Supervision – F.M.H.; Resources – S.C; Materials – S.C., F.M.H.; Data Collection and/or Processing – S.C., F.M.H.; Analysis and/or Interpretation – S.C., F.M.H.; Literature Search – S.C., F.M.H.; Writing – S.C., F.M.H.; Critical Review – F.M.H.*

Declaration of Interests: *The authors have no conflict of interest to declare.*

Funding: *The authors declared that this study has received no financial support.*

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