Knowledge and attitude towards hazardous effects of laser pointers among attendees of football matches in Riyadh, Saudi Arabia

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Abstract:

PURPOSE: There has been a recent increase in accidental retinal injuries due to the careless use of handheld laser devices. The scenarios under which these incidents occur suggest a lack of awareness of the sight-threatening hazards of some handheld lasers. This study aimed to assess knowledge of the population to plan awareness programs and establish protective health policies.

METHODS: This observational cross-sectional study used a newly-developed, validated, and pilot-tested questionnaire to survey attendees of football matches in Saudi Arabia between September to October 2018.

RESULTS: Five-hundred and sixty-nine attendees were surveyed, and 76% of respondents knew laser pointers were harmful and could damage the eye. However, 73% of respondents did not think that the blue laser was dangerous, indicating poor awareness regarding this particular laser. Only 38% knew which ocular structure is most commonly damaged, and 15.6% did not realize that brief exposure can cause vision loss. Females had better knowledge compared to males. Respondents between 25 and 40 years old, females, and married individuals had the highest levels of a positive attitude. There was no statistically significant difference in the mean knowledge score between those in the medical field and other fields ($P = 0.5$).

CONCLUSION: There is an inadequate knowledge of protective measures against handheld lasers. However, there's an overall positive attitude towards spreading awareness about this issue. Yet, targeted awareness campaigns are still needed in addition to more strict government laws to prevent importing or using high-powered handheld laser pointers.

Keywords:

Blue lasers, handheld lasers, laser pointers, ocular damage, retina, retinal injury

INTRODUCTION

The use of lasers is prevalent in many aspects of life, including medicine, engineering, military, and educational tools.^[1] However, handheld laser devices can be misused by many people, including teenagers and at many different places, including home, school, and even public venues such as football stadiums. Lately, highly powered handheld laser devices have been imported into the Middle East and can easily be acquired by the public.^[2] High-power handheld laser devices (up to 1200 milliWatts) resembling low-power pointers are now available

publicly for purchase or via the Internet.^[1] The recent emergence of low-cost, high-power (up to 1400 mW), handheld laser devices have led to multiple cases of retinal injuries in the young population in Saudi Arabia^[1-3] and other parts of the world.^[4] We observed a common behavior during football matches in which attendees shine a laser beam into the eyes of the players. This behavior has the potential to cause serious ocular injuries, given some reported cases of blue laser injuries from distances as far as 1300 feet (396 Meters).^[5] This behavior may reflect a lack of population awareness of ocular laser hazards or may be due to careless and negligent behavior. This study assesses the level of knowledge and

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attitude towards laser pointers among the Saudi population attending football matches.

METHODS

Ethics

The study protocol was approved by the Internal Review Board/Ethical Committee at King Khaled Eye Specialist Hospital, Riyadh, Saudi Arabia.

Participant and data collection

This observational cross-sectional study recruited 569 subjects. The sample included adults who attended football matches in Riyadh, Saudi Arabia. Data collection was carried out in multiple football stadiums from September to the end of October 2018 in which medical students distributed the questionnaire to attendees of football matches.

Study instruments

A primary questionnaire was devised to measure the public knowledge and attitude towards the hazardous effects of blue lasers based on previous literature [Appendix A]. A panel of experts was used to establish content validity. They were asked to assess the overall content of the study instrument and specific questions on whether they do measure attitude, beliefs, and awareness simply. As a pilot study, the survey instrument was tested on individuals ($N = 25$) in the general population from different age groups to assess the language and perception of the questions. No changes were required for the primary questionnaire after the pilot study. The questionnaire comprised of three parts, the first part of the questionnaire consisted of 6 questions that covered demographic information, the second part of the questionnaire consisted of 15 questions that assessed the knowledge of respondents regarding laser pointers. The third part consisted of 8 questions to evaluate the attitude of the respondents towards laser pointer use. To find any associations between knowledge and attitude and demographics of the participants, we used only the participants who completed all questions on these scales. To score knowledge, we computed the total using only the questions where only one answer could be selected. We, therefore, excluded the questions: "what do you think is the most common reason behind purchasing a laser pen" and "what do you think is the reason why some people don't buy a laser pen." The final portion of the knowledge questionnaire consisted of 13 questions, where respondents could answer "yes" or "no." Respondents answering with "I don't know" were considered to have no knowledge. One point was awarded for every correct answer and 0 points for a wrong answer. A total of 13 points could be given for the knowledge questionnaire. The same method was used for the attitude scale. In order to make a total score for the attitude, we excluded one question, "Why would you buy a laser pen." This question was presented separately. The total score for the attitude questionnaire consisted of 7 questions, with a total score of 7 points. Respondents answering with "maybe" were considered to have a positive attitude.

The total scores on knowledge and attitude were measured by calculating the mean score of all items. For knowledge, two groups were created: "good knowledge" and "no knowledge." If participants scored below the mean score of 8, they would be grouped into no knowledge, and a score of 8 or higher was considered good knowledge. For attitude, the mean total score was calculated for all items. If participants scored below the mean score of 5, they were grouped as negative attitudes, and a score of 5 or above, was considered a positive attitude.

Statistical data analysis

Descriptive statistics were used to describe the study population. Percentages and proportions were used to describe the categorical variables and mean score and SD for the total scores as continuous variables. Associations between the demographics of the participants and the knowledge and attitude questionnaire analyzed with the use of the chi-square test or the Fisher exact test, there were appropriate. Reliability analysis was performed by calculating the Cronbach alpha. Statistical significance in this study was set at a P -value < 0.05 . The data were analyzed using Statistical Package for Social Science (SPSS) version 23 (IBM Corp., Armonk, NY, USA).

RESULTS

Questionnaires were distributed to attendants of 9 football matches at Prince Faisal bin Fahd Stadium and King Saud University Stadium in Riyadh, Saudi Arabia. The current study enrolled 569 respondents (379 male, 67.7%; 181 female, 32.3%; Approximately 70% aged between the 19 and 40 years old, and 90% were Saudis; 65.4% were single; 54% had a bachelor's degree or higher. Of the respondents, 86.9% were not working in the medical field [Table 1].

Knowledge

The knowledge questionnaire was further subdivided into questions that assessed the specific knowledge about laser use and damage to the eye and items that evaluated the general knowledge regarding this subject. Cronbach's alpha for this knowledge scale is 0.586.

Most of the respondents (76%) knew that laser pointers are harmful and can damage the eye. Although most of the respondents (71%) had the knowledge that distance between a laser pointer and the eye affects the severity of the damage, few respondents (15.6%) did not know or think that very brief (moments) laser exposure is enough to damage the eye. A quarter of the respondents had no knowledge about protective measures such as goggles that can be used to protect the eye from the laser [Table 2a].

Table 2b presents the general knowledge about the laser. Most of the respondents did not know which type of laser is the most dangerous to the eye; almost 73% of them did not know it was the blue laser [Table 2b]. Thirty-eight percent of respondents indicated that the retina sustains the most ocular damage after

exposure to a laser pen. Most respondents (63.3%) thought that the most common reason to buy a laser pen is for entertainment and amusement.

Table 3 presents the results of the demographic differences in knowledge of laser pointers. Out of the 569 participants, only 280 patients (49.1%) completed all questions on the knowledge questionnaire. Age was significantly associated with having a good knowledge score. Among older respondents (40–64 years old), 94.7% had a good knowledge followed by 25–39 years old age group (80.4%) $P = 0.045$ Females (89.3%) exhibited better knowledge compared to males (79.3%), but this was not statistically significant $P = 0.064$. Interestingly, there was no statistically significant difference in the mean knowledge score between the medical field and other fields ($P = 0.5$).

Attitude

The attitude questionnaire was further subdivided into questions related to the respondent's attitude towards awareness and the attitude towards having a laser pointer. Cronbach alpha calculated for the attitude scale is 0.63.

Table 1: Demographic characteristics

<i>n</i> =569*	Frequency*	Percentage
Sex		
Female	379	67.7
Male	181	32.3
Age		
18 Years or Younger	53	9.5
19-24 Years	238	42.6
25-39 Years	192	34.3
40-64 Years	72	12.9
>64 Years	4	0.7
Educational level		
Low (primary or intermediate school)	13	2.4
Middle (high school and diploma)	210	37.4
High (Bachelor's degree and postgraduate studies)	338	60.2
Marital status		
Single	372	67
Married	172	31
Divorced	7	1.3
Widowed	4	0.7
Field of work		
Medical	71	13.1
Non-Medical	469	86.9

*Not all respondents filled in their complete demographic characteristics

Table 2a: Specific about laser and its damage to the eye

<i>n</i> =569	Yes <i>n</i> (%)	No <i>n</i> (%)	I don't know <i>n</i> (%)	Missing <i>n</i> (%)
Have you ever heard of laser pens and damage to the eye	435 (76.4)	127 (22.3)		7 (1.2)
Do you think laser pens radiation is harmful to the eye	521 (91.6)	41 (1.2)		7 (1.2)
Is laser exposure to the eye for moments enough to damage the eye	285 (50.1)	89 (15.6)	187 (32.9)	8 (1.4)
Does distance between laser and eye affect the severity of damage	408 (71.7)	50 (8.8)	102 (17.9)	9 (1.6)
Does exposure to laser pens cause permanent loss or decrease of vision	387 (68)	26 (4.6)	141 (24.8)	15 (2.6)
Closing the eye during moments of exposure to low energy laser may protect	349 (61.3)	206 (36.2)		14 (2.5)
Are there protective glasses against laser	435 (76.4)	117 (20.6)		17 (3.0)
Do you think the use of protective glasses is effective for laser protection	408 (71.1)	143 (25.1)		18 (3.2)

Of the respondents, 41% used to possess a laser pen in their life. However, 65.9% of the respondent found it is essential to spread awareness about the risk of laser pens, and 63.3% of them were willing to participate in programs that aim to increase awareness about the danger of handheld laser pointers. [Table 4].

Table 4 presents the attitude in relation to demographics. Out of the 569 participants, 542 (95.3%) completed all questions on the attitude questionnaire. The 25–40 years old group had a statistically significantly higher mean score (5.99) than the 40–64 years old group (5.89) ($P = 0.001$). The mean score was statistically significantly lower among males (5.63) than females (6.03) ($P = 0.012$). The mean score was statistically significantly higher for married respondents (6.01) compared to those who were single (5.63) ($P = 0.011$).

Figure 1 presents the reasons for purchasing handheld laser devices. The business was the most common reason $n = 110$ (19.3%), followed by entertainment $n = 109$ (19.2%), and some bought the laser as a weapon to harm others $n = 27$ (2.8%).

DISCUSSION

This study sought to assess the community level of knowledge and attitude towards the recreational use of laser pointers and identify high-risk age groups. The data from this study will aid in establishing effective country-wide awareness programs and policies in the future. Laser pointers are a known cause of ocular injury.^[1,6,7] Locally, in the last decade, there has been an increasing number of injuries related to blue laser devices.^[8] In the UK, it was found that children with behavioral issues were at higher risk of laser exposure secondary to self-harm.^[9]

Figure 1: In percentages

Table 2b: General knowledge about blue laser pen

<i>n</i> =569	<i>n</i>	(%)
What age group owns the highest number of laser pens?		
Children	96	16.9
Adolescents	405	71.2
Elderly	58	10.2
Missing	10	1.8
What do you think is the most dangerous laser to the eye?		
Green laser	150	26.4
Red laser	153	26.9
Blue laser	132	32.2
Violet laser	125	22
Missing	9	1.6
What is the most common ocular tissue involved in laser injury?		
Retina	216	38
Cornea	89	15.6
Lens	34	6
I don't know	215	37.8
No harm	7	1.2
Missing	8	1.4
Exposure of the eye to the laser pen may cause		
Glaucoma	18	3.2
Cataract	16	2.8
Retinal cell damage	259	45.5
No effect	7	1.2
I don't know	259	45.5
Missing	10	1.8
What do you think is the reason why some don't buy a laser pen		
Realize its danger	297	52.2
Difficult access	109	19.2
Parental monitoring	150	26.4
Missing	13	2.3
Do you think that closing the eye during a few moments of exposure to the laser may protect it more against high or low energy laser?		
High energy	126	22.1
Low energy	215	37.8
Not an effective way to protect the eye	214	37.6
Missing	14	2.5
What do you think is the most common reason behind purchasing laser pens?		
Low price	49	8.6
Easy access	119	20.9
Entertainment and fun	360	63.3
Weapon	8	1.4
Business purposes	22	3.9
Missing	11	1.9

In the current study, attendants of football matches in Riyadh, Saudi Arabia were surveyed because we observed a recurring behavior in which the laser beam was directed into the eyes of football players. As a solution, we thought of conducting a survey in this regard to serve as a basis for national legislators to make new regulations towards this behavior.

Since 82.4% of our sample did not work in the medical field, our findings cannot be applied to healthcare workers. However,

Table 3: Demographic differences in knowledge about blue laser pens

	Mean score (SD)	Knowledge		Poor knowledge		<i>P</i> *
		No	%	No	%	
Age						
18 years or younger	8.74 (0.93)	18	75	1	5.3	0.045**
19-24 years	8.75 (1.83)	92	78	26	22	
25-39 years	8.95 (1.5)	78	80	19	20	
40-64 years	9.26 (1.4)	36	95	2	5.3	
>64 years	10.5 (0.6)	4	100	0	0	
Gender						
Male	8.78 (1.7)	162	80	41	20	0.064
Female	9.27 (1.4)	67	89	8	11	
Marital status						
Single	8.84 (1.7)	147	83	31	17	0.753
Married	9.02 (1.5)	77	81	18	19	
Field of work						
Medical field	9.25 (1.6)	31	86	5	14	0.5
Non-medical	8.85 (1.6)	195	82	44	18	
Educational level						
Low	8.50 (2.8)	1	25	3	75	0.585
Middle	8.86 (1.5)	78	80	20	20	
High	8.94 (1.7)	149	84	28	16	

#Only patients for which we could compute a total score on the knowledge questions. *Chi-square test/Fisher exact test. **Significant differences $P < 0.05$

a local study compared the knowledge of laser pointers among ophthalmologists and non-ophthalmologists and indicated that the power used in the latter group's pointers is unknown to 82% and that the majority (90.7%) of study subjects did not know the safety limit of laser pointers they owned.^[10]

To the best of our knowledge, no studies have assessed attitudes towards the hazardous effects of laser pointers among individuals attending football matches. Our findings reveal an overall positive attitude towards spreading awareness about this issue, banning the use of laser pointers, and not purchasing them in the future. In fact, 91.9% of our sample did not own a laser pointer.

We found that the older the respondent was, the more likelihood of them knowing about the hazards of laser pointers hazards ($P = 0.05$). Our findings also reveal that subjects aged between 25 and 40 ($P = 0.001$), females ($P = 0.012$), and married individuals ($P = 0.011$) had the statistically highest percentages of positive attitudes. This suggests that awareness campaigns should target children in schools.

Internationally, the exact incidence of laser injuries remains unknown. Locally, however, a tertiary hospital study reported more than 14 cases from different parts of the Kingdom in one year.^[1] Although the number of injuries has decreased notably in the last two years (unpublished data) due to multiple awareness campaigns conducted by King Khaled Eye Specialist Hospital, the use of laser pointers continues to be observed at football matches. Further targeted awareness campaigns are still needed. Furthermore, government legislation that proposes

Table 4: Demographic differences in attitude about blue laser pen

	Mean score (SD)	Positive attitude		Negative attitude		P*
		No	. %	No	%	
Age						
18 years or younger	5.40 (1.3)	33	68.8	15	31.3	0.002**
19-24 years	5.64 (1.2)	191	83.4	38	16.6	
25-39 years	5.99 (0.99)	168	91.3	16	8.7	
40-64 years	5.89 (1.17)	61	85.9	10	14.1	
>64 years	6.25 (0.5)	4	100	0	0	
Gender						
Male	5.63 (1.2)	296	82.2	64	17.8	0.012**
Female	6.03 (1.02)	161	90.4	17	9.6	
Nationality						
Saudi	5.78 (1.18)	414	84.7	75	15.3	0.718
Other	5.63 (1.26)	33	86.8	5	13.2	
Marital status						
Single	5.63 (1.2)	291	82	64	18	0.011**
Married	6.01 (1.26)	153	90.5	16	9.5	
Field of work						
Medical field	5.96 (1.07)	63	88.7	8	11.3	0.284
Non-medical	5.72 (1.2)	377	83.8	73	16.2	
Educational level						
Low	5.54 (1.61)	3	23.1	10	76.9	0.42
Middle	5.81 (1.13)	177	87.2	26	12.8	
High	5.74 (1.2)	271	83.9	52	16.1	

*Only patients for which we could compute a total score on the attitude questions. * Chi-square test/Fisher exact test. ** Significant differences $P < 0.05$

a significant penalty is required to prevent the entry of laser pointers into stadiums.

Several limitations exist in this study. Due to the busy stadium environment, we were unable to calculate the response rate as the number of surveys sent out was not available. Another limitation is that the Cronbach alpha for the knowledge and attitude questionnaires are very low. The reason is that we were not expecting the questions on the attitude and knowledge questionnaire to be related to each other. The questionnaire is more of a formative model instead of a reflective model. The construct of the questionnaire is the result of the questions. Therefore, we were not expecting a high Cronbach alpha for these questionnaires. In addition, we made a total score for the

items. A higher score indicating higher knowledge or positive attitude. For this, the items on the questionnaires do not need to be related to each other.^[11]

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Nil.

Conflicts of interest

There are no conflicts of interest.

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APPENDIX A

Data Collection Sheet – Research Department – KKESH

Project No.: _____
Project Title: Knowledge and Attitude towards Hazardous Effects of Laser Pointers among Attendants of Football Matches in Riyadh, Saudi Arabia

Demographics:

Name (Optional) .....

Mobile number (optional) .....

1. Age:
  - 18 years or younger
  - 19 to 24 years old
  - 25 to 40 years old
  - 40 to 64 years old
  - Older than 64 years
2. Gender:
  - Male
  - Female
3. Nationality:
  - Saudi
  - Other
4. Marital status:
  - Single
  - Married
  - Divorced
  - Widowed
5. Field of work:
  - Medical field
  - Others
6. Educational level:
  - Primary or intermediate school
  - High school
  - Diploma
  - Bachelor's degree
  - Postgraduate studies

Filled By: _____

Sequence #

Data Collection Sheet – Research Department – KKESH

Project No.: _____
Project Title: Knowledge and Attitude towards Hazardous Effects of Laser Pointers among Attendants of Football Matches in Riyadh, Saudi Arabia

Knowledge

1. Have you ever heard of laser pens and the damage it could cause?
  - Yes
  - No
2. Do you think laser pens radiation is harmful to the eye?
  - Yes
  - No
  - Sometimes
3. What age group owns the highest number of laser pens?
  - Children
  - Adolescents from 13-19 years
  - Elderly
4. What do you think is the most dangerous to the eye:
  - Green laser
  - Red laser
  - Blue laser
  - Violet laser
5. Do you think that laser exposure to the eye for moments is enough to damage the eye?
  - Yes
  - No
  - I don't know
6. Do you think that the distance between laser and the eye affects the severity of the damage to the eye?
  - Yes
  - No
  - I don't know
7. What is the most common ocular tissue involved in laser injury?
  - Retina
  - Cornea
  - Lens

Filled By: _____

Sequence #

Data Collection Sheet – Research Department – KKESH

Project No.: _____
Project Title: Knowledge and Attitude towards Hazardous Effects of Laser Pointers among Attendants of Football Matches in Riyadh, Saudi Arabia

- Has no harm
  - I don't know
8. Exposure of the eye to the laser pens may cause:
    - Glaucoma
    - Cataracts
    - Retinal cell damage
    - Has no effect
    - I don't know
  9. Do you think exposure to laser pens may cause permanent loss or decrease of vision in one or both eyes?
    - Yes
    - No
    - I don't know
  10. What do you think is the most common reason behind purchasing laser pens?
    - Cheap price
    - Easy access
    - Entertainment and fun
    - Weapon
    - For other uses (business purposes)
  11. What do you think is the reason why some people don't buy laser pens?
    - Realize its danger
    - Difficult access
    - Parental monitoring
  12. Do you think closing the eye during moments of exposure to low-energy laser may protect the eye from danger?
    - Yes
    - No
  13. Do you think that closing the eye during a few moments of exposure to the laser may protect it more against high or low-energy laser?
    - High energy
    - Low energy
    - Not an effective way to protect the eye

Filled By: _____

Sequence #

Data Collection Sheet – Research Department – KKESH

Project No.: _____
Project Title: Knowledge and Attitude towards Hazardous Effects of Laser Pointers among Attendants of Football Matches in Riyadh, Saudi Arabia

Attitude

1. Do you think there are protective glasses against laser?
  - Yes
  - No
2. Do you think the use of protective glasses is effective for laser protection?
  - Yes
  - No
3. Do you think that spreading awareness information about the risk of laser pens and limiting its sale may reduce the incidence of laser-related injuries in Saudi Arabia?
  - Yes
  - No
  - To a certain extent
4. Do you think that laser pens should be banned?
  - Yes
  - No
  - To a certain extent
5. Is it possible that you participate in increasing the awareness of Saudi society about the dangers of laser pens?
  - Yes
  - No
  - Maybe
6. Do you own a laser pen?
  - Yes
  - No
7. Have you ever owned one of the laser pen?
  - Yes
  - No

Filled By: _____

Sequence #

Data Collection Sheet - Research Department - KKESH

Project No.: _____
Project Title: Knowledge and Attitude towards Hazardous Effects of Laser Pointers among Attendants of Football
Matches in Riyadh, Saudi Arabia

8. Is it possible to purchase a laser pen in the future?
- Yes
  - No
  - Maybe
9. If your answer was "yes", why would you buy it?
- For business purposes
  - Use it to harm others' eyes
  - Entertainment and fun
  - Weapon
10. Will you report who owns laser pen for the purpose of damaging the eyes of others?
- Yes
  - No
  - Maybe
11. Have you attended any football games in the stadium during the previous two years?
- Yes
  - No
  - Maybe
11. Specify.....

Filled By: _____

Sequence #