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RESEARCH ARTICLE

Adopting ICL of Eye Health for Patients with Sever Visual Impairment in Missan City, South Of Iraq

Husam Uldeen Hato Mohammed[1*], Leila Knani Md[2*]

[1]Al_Sadder Teaching Hospital, missan city, Iraq
[2]Faculty of medicin Ibin El Jazzar, University of Sousse, Tunisia

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***Corresponding Author:**

LeilaKnani@gmail.com
hussam.hatow@yahoo.conm

ABSTRACT

The global prevalence of refractive error varies based on factors such as the population being researched, the method of sample selection, and the criteria used to classify it. Factors such as ethnicity, geographical location, environmental conditions, and age likely play a role in the occurrence and distribution of refractive errors, specifically myopia. The objective of the study is to evaluate the efficacy and acceptance of novel eye health technology among individuals with minor visual impairment in Missan City, situated in southern Iraq.

A cross-sectional population-based design is used in this investigation. The study ran from December 1, 2022, to April 30, 2023, at AL-Sadder Teaching Hospital in Missan, Iraq. Participation was open to all hospitalized patients with eye symptoms; a total of 768 senior patients were randomly chosen to make up the sample. Using specially created data sheets, information about demographics, past medical history, specifics of ocular therapies, and evaluations of ICL for treating eye conditions were gathered. SPSS-24 was used for data analysis, and a p-value of 0.05 was used to indicate statistical significance.

The study examined the characteristics and therapeutic outcomes of 400 patients afflicted with eye disorders. The majority of individuals were male, comprising 54% of the total, and were between the ages of 25 and 30, making up 43.5% of the population. The pre-operative visual acuities ranged from hand motion perception to a visual acuity of 6/60. Following the ICL, smile and Lasik procedure, a significant enhancement in vision was noted, with 49.2% of the patients reaching 6/6 vision.

The findings of this study demonstrate that the implementation of novel technology successfully enhanced visual acuity in individuals with minor visual impairment.

INTRODUCTION

The frequency of myopia is on the rise due to the extensive utilization of technologies such as mobile phones and tablets (1). According to researchers, it is projected that in 30 years, the worldwide occurrence of myopia will approach around 50%, while the occurrence of severe myopia would approach nearly 10% (2). At now, keratorefractive laser surgery is the primary approach used to treat myopia (3). However, certain individuals are not eligible for this operation due to the condition of their corneas (4). ICL surgery is a highly successful treatment for myopia (5).

The issue of visual quality has garnered more attention in the field of refractive surgery in recent years (6). Typically, vision quality is categorized into objective and subjective aspects (7). The assessment of vision quality often involves the evaluation of higher-order aberrations, modulation transfer function (MTF), objective scatter index (OSI) value, and other related factors (8). ICL demonstrated superior objective visual outcomes compared to LASIK and SMILE for high myopia correction (9). Nevertheless, only a small number of individuals have conducted research and made comparisons about the subjective quality of vision.

Despite the growing popularity of ICL in Asia and the European Union, the number of ICL cases remains significantly lower than excimer laser refractive operations, particularly for myopia with less than 6.0 diopters (D). Our previous clinical results have already shown that ICL can provide satisfactory levels of safety, predictability, and stability for high myopia (10). Furthermore, several studies comparing keratorefractive laser surgery with ICL implantation for high myopia correction have consistently demonstrated that the latter technique offers better refractive accuracy and subjective visual quality (11). Currently, there is a scarcity of randomized controlled trials that compare the effectiveness of ICL and SMILE in treating low to moderate myopia. The objective of the study is to evaluate the efficacy and acceptance of ICL technique among individuals with minor visual impairment in Missan City, situated in southern Iraq.

METHOD

Study design and setting

This study utilizes a cross-sectional population-based design. The study was carried out at AL-Sadder Teaching Hospital in Missan, Iraq, spanning from December 1, 2022, to April 30, 2023.

Participants

400 senior patients were picked at random, according to the projected sample size. Patients were chosen during their clinical appointments at the hospital, and they provided written consent after being fully informed about the study.

Inclusion criteria

1. Patients who have previously experienced minor visual impairment.

2. Patients living in the city of Missan, located in the southern region of Iraq.

3. Patients who are 22 years of age or older.

4. Patients who give explicit agreement to participate in the study.

Exclusion Criteria

1. Patients who have previously experienced significant vision impairment.

2. Individuals who have previously experienced eye injuries.

3. Patients who have cognitive problems that hinder their capacity to engage.

4. Patients having a medical history of notable systemic disorders that have had an impact on the health of their eyes.

Statistical analysis

Data were gathered utilizing specifically crafted data sheets, including demographic data, previous medical records, particulars of eye surgeries, and evaluation of novel eye treatment technologies. The data analysis was conducted using SPSS-24, with a predetermined level of statistical significance set at $p < 0.05$.

Ethical considerations

The research ethics committees in the Missan Directorate of Health have granted the official agreement. Authorization has been obtained from the Missan directorate of health. Before participating, all participants or their legal guardians, if the individuals were unable to offer consent individually, were required to give written informed consent. Participants were thoroughly informed about the study's aims, procedures, potential hazards, and benefits prior to giving their consent.

RESULTS

The study was conducted at Alsadder Teaching Hospital in Misan city, Iraq, involving 400 patients who were suffering from eye disorders. Out of these patients, 216 (54%) were male and 184 (46%) were female. The study revealed that 43.5% of the patients were in the age range of 25-30 years, 24% were in the age group of 36-40 years, 18.2% were in the age group of 30-35 years, 12.8% were in the age group of 41-45 years, and 1.5% were in the age group of 46-50 years. The investigation revealed that among the patients, 45.5% (182 individuals) had a college education, 40.8% (193 individuals) had completed primary education, 9.5% (36 individuals) had graduated from an institute, and 4.8% (19 individuals) had a postgraduate degree, as indicated in Table 1.

Table 1: characteristics of study sample (patients)

Characteristics		frequency	%
Age groups (year)	25-30	174	43.5
	31-35	73	18.2
	36-40	96	24
	41-45	51	12.8
	46-50	6	1.5
	Total	400	100
Education level	Reading and write	163	40.8
	Institute graduate	36	9
	College graduate	182	45.5
	Post graduate	19	4.8
	Total	400	100

Regarding visual acuity, before the treatment procedure, 51 patients (12.8%) had count finger (CF) visual acuity (2-5 finger), 127 patients (31.8%) had 6/18 visual acuity, and 61 patients (15.2%) had 6/60 visual acuity. After correction, 197 patients (49.2%) improved to 6/6 visual acuity, 128 patients (32%) improved to 6/12 visual acuity, and similar improvements were observed for other patients as shown in table 2.

In table 3, it was seen that out of the total number of glasses degrees, 342 (85.5%) were negative and 58 (14.5%) were positive. The mean value was 6 with a standard deviation of 3. However, there was no statistically significant difference observed.

Table 3: glasses degree of study sample

Glasses degree (BE ds)	Mean ± SD	Max	Min.	Total	%	P value
Positive	6± 4	13	1	58	14.5	0.9
Negative	6± 3	14	1	342	85.5	

The present investigation revealed that the treatment technique for correcting eye abnormalities in patients was distributed as follows: 212 patients (53%) showed improvement after undergoing the ICL operation.

There was a statistically significant difference (p value less than 0.01) in visual acuity before and after correction with the treatment process. The majority of patients with visual acuity of count finger, 6/18, 6/24, and 6/60 were improved to visual acuity of 6/6 and 6/9 (table 3). Regarding the degree of spectacles, the majority of patients (342) have a negative BE.

Treatment procedure - correction

The treatment process was mostly conducted on patients within the age categories of 25-30 and 36-40 years, which showed a statistically significant difference (p value 0.000) compared to other age groups, as indicated in table 4. The ICL treatment was performed on a greater number of females than males, with 112 females and 100 males, respectively. Conversely, the other operation was performed on a greater number of males than females, and this difference was statistically significant (p value 0.014), as shown in table 4. The ICL procedure was performed more frequently on employee patients (198) compared to individuals in other occupations such as free workers and housewives. This difference was shown to be statistically significant with a p-value of 0.0001 (table 4). The majority of college graduates (160) had the ICL process, while the majority of reading and writing was done with LISK (85) and femto smile (62) with notable impact.

Table 4: the relation between the treatment procedure and characteristics of patients.

Characteristics		Treatment procedure								
		ICL		LISK		Femto smile		Total		P value
		N	%	N	%	N	%	N	%	
Age	25-30 yr	60	28.3	62	57.4	52	65	174	43.5	0.000
	31-35 yr	47	22.2	16	14.8	10	12.5	73	18.2	
	36-40 yr	65	30.7	21	19.4	10	12.5	96	24	
	41-45 yr	34	16.0	9	8.3	8	10	51	12.8	
	46-50 yr	6	2.8	0	.0	0	.0	6	1.5	
Sex	male	100	47.2	67	62	49	61.2	216	54	0.014
	female	112	52.8	41	38	31	38.8	184	46	
Occupation	employee	198	93.4	20	18.5	18	22.5	236	59	0.0001
	free work	7	3.3	57	52.8	45	56.2	109	27.2	

	housewife	7	3.3	31	28.7	17	21.2	55	13.8	
Education level	Reading /write	17	8	85	78.7	61	76.2	163	40.8	0.000
	Institute graduate	17	8	13	12	6	7.5	36	9	
	college graduate	160	75.5	9	8.3	13	16.2	182	45.5	
	Post graduate	18	8.5	1	.9	0	.0	19	4.8	
visual acuity after correction	6/6	43	20.3	96	88.9	58	72.5	197	49.2	0.000
	6/9	96	45.3	10	9.3	22	27.5	128	32	
	6/12	54	25.5	2	1.9	0	.0	56	14	
	6/18	19	9	0	.0	0	.0	19	4.8	
	Total	212		108		80		400		
visual acuity before correction	C F	50	23.6	0	.0	1	1.2	51	12.8	0.000
	6/12	0	.0	48	44.4	6	7.5	54	13.5	
	6/18	19	9.0	56	51.9	52	65	127	31.8	
	6/24	63	29.7	4	3.7	12	15	79	19.8	
	6/36	24	11.3	0	.0	4	5	28	7	
	6/60	56	26.4	0	.0	5	6.2	61	15.2	
	Total	212		108		80		400		
Glasses degree (BE ds)	positive	27	12.7	16	14.8	15	18.8	58	14.5	0.4
	negative	185	87.3	92	85.2	65	81.2	342	8	
	Total	212		108		80		400		

Finally, there was a statistically significant difference in visual acuity before and after the treatment method performed on patients, as indicated in table 5.

Table 5: Relationship between before and after of visual acuity

		visual acuity after correction					
		6/6	**6/9**	**6/12**	**6/18**	**Total**	**P value**
		N	**N**	**N**	**N**	**N**	
visual acuity before correction	CF	1	9	27	14	51	0.000
	6/12	53	0	1	0	54	
	6/18	116	9	1	1	127	
	6/24	20	53	6	0	79	
	6/36	3	23	2	0	28	
	6/60	4	34	19	4	61	

	Total	197	128	56	19	400	

DISCUSSION

Vision impairments are exceedingly widespread, impacting an estimated 2.2 billion individuals across the globe (12). Approximately 36 million of these individuals are classified as blind, while an estimated 217 million suffer from marked visual impairment, which is defined as moderate to severe (13). Keratorefractive laser surgery is presently the predominant method employed in the management of myopia (14). Nevertheless, specific individuals are deemed ineligible for this procedure on account of the state of their corneas. The objective of the study is to evaluate the efficacy and acceptance of novel eye health technology among individuals with minor visual impairment in Missan City, situated in southern Iraq

A study involving 400 eye disorders patients found that 54% were male and 46% female. The majority were aged 25-30 years, with 43.5% aged between 25-30 years. The majority were in the 30-35 age range, 12.8% aged 41-45 years, and 1.5% aged 46-50 years. The majority had a college education, with 45.5% having completed primary education. The remaining 9.5% had graduated from an institute, and 4.8% had a postgraduate degree.

Blindness and visual impairment affect women to a significantly greater extent than men, according to mounting evidence accumulated over the past decade (15).

In the study of Rius Ulldemolins et al., (16) he found that females exhibited a higher probability of reporting visual impairment (unadjusted odds ratio = 1.6 [95% confidence interval: 1.56-1.74]). The occurrence of identified cataract was more common among visually impaired women (crude odds ratio = 1.4 [95% confidence interval: 1.25-1.67]). On the other hand, undiagnosed eye disease (crude odds ratio = 0.7 [95% confidence interval: 0.64-0.81]) or diagnosed glaucoma (adjusted odds ratio for sex = 0.8 [95% confidence interval: 0.65-0.93]) were more prevalent among visually impaired males. Age and educational level did not account for these correlations.

The study of Bourne, et al., (17) in 2020, approximately 43.3 million individuals were visually impaired, with 23.9 million being female. The global prevalence of blindness among adults aged 50 years or older decreased by 28.5% between 1990 and 2020, with a slight decrease in mild vision impairment and an increase in moderate and severe vision impairment. However, there was insufficient data to calculate the prevalence of vision impairment from uncorrected presbyopia. Between 1990 and 2020, there was a 50.6% increase in the number of individuals experiencing blindness and a 91.7% increase in moderate and severe vision impairment. By 2050, the number of blind individuals is estimated to be 61.0 million, with 474 million people with moderate and severe vision impairment, 360 million with mild visual impairment, and 866 million with uncorrected presbyopia. The study also found that there were a 50.6% increase in the number of individuals experiencing blindness and a 91.7% increase in moderate and severe vision impairment. The study suggests that by 2050, the number of blind individuals will be 61.0 million.

LASIK is currently the most widely used surgical procedure for correcting nearsightedness using laser technology. Femtosecond laser-assisted LASIK (FS-LASIK) enables the development of flaps that are more predictable in terms of their thickness, diameter, and hinge width (18). Small incision lenticule extraction (SMILE) is a contemporary method that uses a femtosecond laser to fix refractive defects, and it has become increasingly popular. This procedure has been proposed as a substitute for LASIK in the treatment of myopia, with certain benefits (19). The use of laser corneal refractive surgery (ICL) for correcting myopia has gained widespread acceptance. Nevertheless, there is a potential danger of iatrogenic keratoconus in those with moderate to severe refractive defects or poor cornea thickness.

Regarding visual acuity, before the treatment procedure, 51 patients (12.8%) had count finger (CF) visual acuity (2-5 finger), 127 patients (31.8%) had 6/18 visual acuity, and 61 patients (15.2%) had 6/60 visual acuity. After correction, 197 patients (49.2%) improved to 6/6 visual acuity, 128 patients (32%) improved to 6/12 visual acuity, and similar improvements were observed for other patients as shown in table 2.

A study examined the history, indications, and contraindications of SMILE in comparison to LASIK. Several studies have demonstrated that SMILE, a relatively recent refractive surgery procedure, produces consistent and effective results, with a high level of safety (20).

Ganesh et al. (21) performed a study where they compared the visual outcomes and patient satisfaction using toric implantable collamer lens (T-ICL), femto-LASIK, and ReLEx SMILE for correcting low to moderate myopic astigmatism in a matched population. Their study comprised a cohort of 30 individuals who underwent bilateral surgery using any of the three techniques. Upon conducting a 1-year follow-up, it was determined that all three techniques proved to be efficacious in correcting myopic astigmatism. ReLEx SMILE showed a high success rate in obtaining uncorrected distance visual acuity (UDVA) of 20/20 or greater (97%), which is comparable to T-ICL (93%) and superior than femto-LASIK (90%). This further substantiates the efficacy of these operations in enhancing visual acuity. This investigation demonstrated the efficacy of the treatment approaches in improving visual acuity in patients with mild visual impairment, ultimately leading to better eye health outcomes.

The study analyzed the characteristics of patients undergoing eye procedures at Alsadder Teaching Hospital. The age group with the highest number of procedures (43.5%) was the 25-30 age group, possibly due to the hospital's focus on conditions like myopia. Lifestyle factors and increased screen time in Missan City could also contribute to vision problems in younger people. A significant difference was observed between males and females, with males undergoing procedures more often than females. Office workers had the highest percentage of procedures (59%), while housewives and students had lower percentages. Patients with a reading/writing education level had the highest percentage (40.8%), followed by college graduates. This could be due to selection bias, awareness, and affordability.

After correction, most patients achieved 6/6 or 6/9 vision, suggesting the procedures were generally successful. However, a significant portion (68.8%) had pre-operative visual acuity worse than 6/18, indicating a need for vision correction. The study showed a higher preference for LASIK/Femto-LASIK procedures compared to ICL, possibly due to cost-effectiveness and patient suitability. ICL may be used for specific cases not suitable for LASIK, such as thin corneas.

In a study conducted to analyze and contrast the cost-effectiveness of three different procedures SMILE, FS-LASIK, and photo refractive keratectomy (PRK) - in the treatment of myopia and myopic astigmatism, it was found that the utility values assigned to SMILE and PRK were 0.8, while the utility value assigned to FS-LASIK was 0.77. The weighted quality-adjusted life years (QALYs) were 24 for SMILE and PRK, and 23.1 for FS-LASIK. The mean weighted costs were 335.45€, 443€, and 346.96€, respectively. The incremental cost-effectiveness ratios for SMILE, PRK, and FS-LASIK were 13.98 €/QALY, 18.46 €/QALY, and 15.02 €/QALY, respectively. A negative link was seen between the Incremental Cost-Effectiveness Ratio (ICER) and the duration (in years) following the surgical procedure. In order to generate a profit, a minimum of 155 patients must be treated annually for SMILE, 136 for PRK, and 155 for FS-LASIK (22)

CONCLUSION

The study examined the efficacy of eye health treatments (LASIK,Femto SMILE, ICL) in enhancing visual acuity in individuals with moderate visual impairment in Missan City, Iraq. 49.2% of patients achieved 6/6 vision following ICL, SMILE, or LASIK surgeries, according to the cross-sectional,

population-based study, which included 400 participants. The study's limitations, which include the focus on hospital-admitted patients and the combination of data from three methodologies, may not be appropriate for specific analysis. Outpatients should be taken into account in future research, which should also specify specific inclusion criteria. Detailed information would be obtained by examining the efficacy of ICL, SMILE, and LASIK surgeries individually. The robustness of the findings would be improved by the incorporation of a control group and patient tracking over an extended period. The study offers an optimistic beginning for the exploration of the potential of innovative eye health technologies in improving vision for patients with modest visual impairment, despite these limitations.

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