Impact of teleconsultation on visual and refractive outcomes in patients undergoing laser refractive surgery during COVID-19

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Purpose: To assess the role of remote teleconsultation (TC) follow-up care following a successful and uneventful laser vision correction. Methods: The study is a retrospective, comparative analysis of patients undergoing laser vision correction at tertiary care eye hospital in Southern India. The patients were divided into two groups. The first group included patients operated on before the coronavirus disease (COVID-19) pandemic and were followed up with physical consultations during their follow-up visit (Group 1). The second group comprised patients operated on during the pandemic and had at least one remote TC during their post-operative follow-up (Group 2). Results: A total of 1088 eyes of 564 patients and 717 eyes of 372 patients were included in Group 1 and 2, respectively. The mean number of visits for the patients from Group 2 during the COVID period (2.56 +/- 0.74 days) was significantly lesser (P < 0.0001) than that of Group 1 in the pre-COVID period (3.53 +/- 1.07 days). Close to 90% of the eyes achieved an uncorrected distance visual acuity (UDVA) of 20/20 in both groups (P = 0.925). 96.50% of the eyes in Group 1 and 98.18% of the eyes in Group 2 achieved UCVA 20/25 or better (P = 0.049). Eight eyes (0.73%) in Group 1 and one eye (0.14%) in Group 2 reported a loss of 2 or more lines. However, the results were not statistically significant (P = 0.156). None of the groups had any patients who had a sight-threatening complication. Conclusion: Remote TC following refractive surgery is safe and can be effectively integrated into routine refractive practice to reduce travel to the hospital for a physical consult.

Key words: COVID-19, LASIK, PRK, refractive surgery, teleconsultation

Telemedicine is a rapidly progressing and evolving amalgamation of information and communication technology with existing health care systems to help bridge the gap between the health care provider and the patients. It enables health care professionals to screen, diagnose, counsel, and manage patients remotely through any available mode of communication.

With new guidelines by the Government of India and All India Ophthalmic Society (AIOS), telemedicine has gained a great deal of impetus.1,2 During the existing coronavirus disease (COVID-19) pandemic, telemedicine services have seen an unprecedented and unforeseen rise in demand and utilization. They have emerged as an accessible, time-sparing, and cost-effective mode of communication for patients seeking remote health care services.3-7

Before the COVID-19 pandemic, teleconsultation (TC) was used effectively to practice comprehensive ophthalmology and later screen diabetic retinopathy, retinopathy of pre-maturity, and glaucoma.8-11 This was merely performed to rule out the presence or absence of disease by sharing the images remotely with an eye specialist. During the pandemic, various other specialties have adopted TC services.12-15 However, its role in refractive surgeries has not been explored yet. This study aims to understand the utility of introducing TC services for patients undergoing laser vision correction: Laser in situ keratomileusis (LASIK), photorefractive keratectomy (PRK), and small incision lenticule extraction (SMILE).

Methods

This study is a retrospective, comparative analysis of patients undergoing post-operative care following laser vision correction conducted at a tertiary care eye hospital in Southern India. The patients were divided into two groups based on the period they were operated upon and the type of visits they had. The first group (Group 1) included patients who were operated on before the COVID-19 pandemic hit the country (September 1, 2019 to February 28, 2020), whereas the second group (Group 2) had patients operated during the pandemic (September 1, 2020 to February 28, 2021). Patients aged over 18 years with normal pre-operative corneal topography, with normal pre-operative anterior and posterior segment findings, and operated for either one of the laser refractive procedures (LASIK, PRK, and SMILE) were included in the study.
TC services were started in our institute during the lockdown because of COVID-19 during the second quarter of the year 2020 to cater to the needs of patients who could not travel to the institute because of either ill health or travel restrictions. Later on, the services were extended to the patients to help reduce the number of post-operative visits after the surgery, with at least one of the visits being TC. The decision of converting a physical visit to a TC after the surgery was taken by the treating physician after a detailed conversation with the patient and if the patient was willing. Following refractive surgery, the TC was performed within 3 days of the surgery by the operating surgeon. For further follow-ups, these patients were advised for physical consultation or TC depending on the patient’s comfort, self-assessed vision, and eye condition.

Group 2 included patients who had at least one TC after the surgery. During varying travel restrictions, physical follow-ups were sporadic, and to make the two groups comparable, the follow-ups till 5 months (150 days) post-operative were used for comparison. For patients undergoing LASIK/SMILE, those with a minimum of 1 month of follow-up after surgery were included in the study. Patients with PRK having at least 6 weeks follow-up after surgery were considered for final analysis.

None of the patients in Group 1 (pre-COVID) had a TC. However, in Group 2, patients who did not have a TC after the surgery or had only TCs without further physical follow-ups were excluded from the study. Patients with ocular co-morbidity or those who underwent enhancement procedures for the residual error from previous laser correction surgeries and those who could not follow up after the surgery were excluded. Patients with a best-corrected distance visual acuity (BDVA) less than 20/20 during the pre-operative evaluation, those planned for under-correction or mono-vision, and those with other factors that influenced the post-operative visual outcome, for example, choroidal neovascular membrane (CNVM), trauma, and so on, were excluded from the study.

Electronic medical records (EMRs) of patients fulfilling the above criteria were retrieved and subjected for further analysis. The institutional review board permission was sought, and the study adhered to the tenets of the Declaration of Helsinki.

At the final visit, the uncorrected distance visual acuity (UDVA) and BDVA were considered for analysis. The two groups were compared based on the following outcome measures:

a. The proportion of patients having a UDVA of 20/20 or better in each group at the final follow-up
b. The proportion of patients having a BDVA of 20/20 or better in each group at the last follow-up
c. The proportion of patients with loss of one or more lines in each group at the final follow-up
d. Complications related to the surgery during the follow-up period

The data were managed using Microsoft Excel (Microsoft Work Professional 2013), and statistical analysis was performed using Excel and GraphPad Prism software. Student’s t-test was used to calculate the difference between means, whereas the Chi-square test was used for all the categorical data. 95% confidence interval was calculated wherever necessary, and the results were considered significant at $P < 0.05$.

Results

A total of 1088 eyes of 564 patients and 717 eyes of 372 patients were included in Group 1 (pre-COVID) and Group 2 (COVID), respectively. The baseline characteristics of both the groups were comparable and are shown in Table 1.

PRK was the most common surgery performed, followed by LASIK and SMILE. Between the two groups, PRK was more commonly performed in Group 1 (63.59%) than in Group 2 (58.63%, $P = 0.039$), whereas LASIK was more widely performed in Group 2 (33.73%) than in Group 1 (29.01%, $P = 0.039$). The mean number of physical visits for the patients from Group 2 (2.56 +/- 0.74 days) was significantly lesser ($P < 0.001$) than that for patients in Group 1 (3.53 +/- 1.07 days).

Close to 90% of the eyes achieved a UDVA of 20/20 in both groups ($P = 0.925$). 96.50% of the eyes in Group 1 and 98.18% of eyes in Group 2 achieved UDVA 20/25 or better ($P = 0.049$). Eight eyes in Group 1 and one eye in Group 2 reported loss of more than two lines; however, the difference was not statistically significant ($P = 0.156$) [Fig. 1a-d]. The list of complications and outcomes are reported in Table 2.

Discussion

The COVID-19 pandemic has hurled many challenges for entire nations: Physical, mental, social, and economic. Timely lockdowns and travel restrictions have curtailed the spread of the disease to a certain extent. However, the disease is far from over, and continued safety measures such as wearing a mask and maintaining social distancing seem the only way forward.[16] The pandemic has forced patients to remain away from health care services unless necessary. However, advancement in technology, amendment in laws, updated guidelines from Governments, and, most importantly, increased awareness have driven greater acceptance for remote consultations by telemedicine.[17] Telemedicine guidelines classify patients seeking or advised a TC in two categories: Fresh patients and follow-up patients. New patients are those who are consulting for the first time. Follow-up patients include those who have had a physical check-up not more than 6 months before the date of the TC by the same physician and for the same problem.[31]

In a study from the US, the mean time spent by the patients in an eye care facility was noted to be 43 +/- 38 minutes (0 to 184 minutes).[15] In another study from Iran, the average time spent by patients in an Ophthalmology department at an educational institute was 245 minutes.[18] In the refractive clinic, patients require detailed pre-op evaluation, including detailed history taking and slit-lamp examination, followed by dry and cycloplegic refraction, diagnostic scans, dilated fundus examination, and surgery counseling. This significantly increases the chair time and waiting time. However, the follow-up visits are usually much shorter with a lesser time spent in the clinic. Nonetheless, the increase in wait time for any of the patients reduces the chances of maintaining social distancing. It significantly increases the risk of infection for all the patients present at that point in time. Additionally, travel to the health system for a follow-up check-up increases the risk of exposure and is an additional cost to them and the health system.
Reduction of any follow-up visits for the patients would help decongest health care facilities with potentially increased safety for the patient and health care providers.

In our study, one such physical follow-up visit, following laser vision correction, was converted into a TC. The TC was based on the operating surgeon’s discretion and was performed within the first 3 days of surgery as a post-operative follow-up. The total number of visits for the patients was significantly reduced from 3.53 +/- 1.07 days to 2.56 +/- 0.74 days. TC in the early post-operative period can have multiple advantages.[9]

For patients, it not only saves time but also reduces the risk of contracting an infection while travelling or during their visit to the hospital. It also enables them to have an accessible and faster mode of communication with the surgeon from the confines of their homes. It is also cost-effective as it saves travelling expenses to the patients and reduces the burden for health systems while making social distancing easier to maintain. For the hospital, staff, and the other patients, the reduction in the number of patients in the clinic reduces the chair time and eventually reduces the risk of exposure to the infection. For continued care, documentation from the TC visit was maintained, and a copy of the visit was attached to the existing electronic medical record of the patient. In this study, the visual outcomes between patients who had at least one TC and those who did not have one were comparable. 0.73% and 0.14% patients reported the loss of two or more lines in Group 1 and Group 2, respectively (P = 0.156).

Post-operative check-up following LASIK is primarily performed with an intent to detect flap folds or any other flap-related complications and in PRK to confirm the presence and fit of a bandage contact lens and modulate pain-relieving medication or the presence or absence of infection. This has been a routing protocol of follow-up physical visits at our hospital for the past 20 years, with the patient visiting on the first post-op day, followed by a visit within the first week after surgery and at a month following surgery. None of the complications or the untoward effects noted in this study was vision-threatening. Flap folds were noted in two patients in

### Table 1: Comparison of baseline characteristics between the pre-COVID and COVID groups

|                      | Group 1                                      | Group 2                                      | P     |
|----------------------|----------------------------------------------|----------------------------------------------|-------|
| **N**                | 1088 eyes of 564 patients                    | 717 eyes of 372 patients                     | -     |
| Both eyes            | 524                                          | 345                                          |       |
| Right eye            | 18                                           | 12                                           |       |
| Left eye             | 22                                           | 15                                           |       |
| **Age**              |                                               |                                               |       |
| Mean:                | 25.94 +/- 3.87 (95% CI 25.94±0.320 )          | 25.73 +/- 4.54 (95% CI 25.73±0.461 )          | 0.4   |
| Range:               | 18 to 48                                     | 18 to 50                                     |       |
| **Sex**              |                                               |                                               |       |
| Male:                | 267                                          | 172                                          | 0.791 |
| Female:              | 297                                          | 200                                          |       |
| **Number of surgeons involved** | 11                                           | 8                                            | -     |
| **Types of surgeries performed:** |                                               |                                               |       |
| 1. LASIK             | 367 (33.73%)                                 | 208 (29.01%)                                 | 0.039*|
| a. Femtosecond topography-guided LASIK | 129 eyes                                     | 69 eyes                                      |       |
| b. Femtosecond wavefront-optimized LASIK | 131 eyes                                     | 80 eyes                                      |       |
| c. Topography-guided LASIK | 40 eyes                                      | 27 eyes                                      |       |
| d. Wavefront-optimized LASIK | 67 eyes                                      | 32 eyes                                      |       |
| 2. PRK               | 638 (58.63%)                                 | 456 (63.59%)                                 | 0.9   |
| a. Wavefront-optimized PRK | 319 eyes                                     | 204 eyes                                     | 0.039*|
| b. Topography-guided PRK | 319 eyes                                     | 252 eyes                                     |       |
| 3. SMILE             | 83 eyes (7.62%)                               | 53 eyes (7.39%)                              | 0.9   |
| **Mean number of visits for the patients during their follow-ups in 5 months** | 3.53 +/- 1.07 (95% CI +/- 0.08)               | 2.56 +/- 0.74 (95% CI 0.07)                   | 0.0001*|
| Range:               | 2-14 days                                    | 2-5 days                                     |       |

| **Refractive errors:** |                                               |                                               |       |
| a. Compound myopic astigmatism | 288 eyes                                     | 511                                          |       |
| b. Simple myopia              | 788 eyes                                     | 199                                          |       |
| c. Simple myopic astigmatism  | 10 eyes                                      | 7                                            |       |
| d. Mixed astigmatism          | 2 eyes                                       | -                                            |       |
| **Spherical equivalent**     |                                               |                                               |       |
| Mean:                          | -4.48 +/- 2.16 (95% CI±0.128)                | -4.73 +/- 2.07 D (95% CI±0.152)              | 0.0146*|
| Range:                         | -0.5 to -13.875 D                            | -0.25 to -11.5 D                             |       |

LASIK – laser in situ keratomileusis, PRK – photorefractive keratectomy, SMILE – small incision lenticule extraction. *test significant at P<0.05
the TC group (Group 2). Both these patients reported early to the clinic after sustaining an injury and were managed successfully with flap re-lift and good visual recovery. One patient with microbial keratitis in the non-TC group (Group 1) recovered well and regained a BDVA of 20/30 after successful management with medical therapy. Only two and three eyes in Group 1 and 2, respectively, lost one or more lines because of post-PRK haze at their last follow-ups. \( P = 0.353 \). The reduction of one physical visit in the immediate post-operative visit did not seem to change the post-operative outcomes in terms of complications or undesirable side effects between the two groups.\(^{[20]}\)

On the flip side, a teleconsult instead of a physical visit can potentially have drawbacks.\(^{[19,21]}\) Vision assessment is inaccurate in an uncontrolled environment, and symptoms of infections in the immediate post-operative period can overlap with those following PRK surgery. This could potentially result in a delay in the management of such patients. Photographs shared by patients during TC might not be clear, and findings would primarily be dependent on the history and the judgment of the attending physician. Video consultations could help to a certain extent as both physicians and the patient can see each other in the real time and help build the doctor–patient relationship. Finally, from the medicolegal perspective, it is crucial to take informed consent from patients seeking the services, explain the limitations of a TC, and diligently document each of the TC visits to ensure safety and compliance. TC is not a replacement for a physical check-up. The treating surgeon should decide to have a TC instead of a physical review after exercising the professional judgement in the patient’s best interest.

**Conclusion**

From this study, TCs in the early post-op period for patients undergoing uneventful refractive surgery appear to be a viable
alternative to reduce one physical visit and can be used in routine refractive practice to provide continuity in the care after an uneventful laser vision correction. It is an evolving field with more and more health care providers and patients opting for it. However, it is essential to understand the limitations, merits, and demerits and embrace and integrate these services in existing health care services with the caveat that at the first suspicion of a potential problem, the patient is brought back for a physical consultation.

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Conflicts of interest
There are no conflicts of interest.

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