

Effect of Orthokeratology Lenses on Restoring Visual Acuity

Fen-Fen Huang, Zong-Bao Chen, Jian-Chen Su, Yue-Jin Wang

Abstract— This study investigated the experience of users in wearing orthokeratology lenses, their subsequent visual acuity, and their opinions on said lenses. This study adopted a quantitative survey research method, with a questionnaire that was developed based on the said author's past orthokeratology-wearing experiences and possible concerns that arise from wearing these lenses. The analysis results are consistent with those regarding the long-term effects of wearing orthokeratology lenses as described in the literature review section. For example, nearly 60% of the participants felt that visual acuity and the cornea would degenerate if they stopped wearing orthokeratology lenses within one year. Although studies have confirmed that wearing orthokeratology lenses has an immediate effect on ameliorating nearsightedness, the long-term effects on the health and morphological changes of the corneas must be evaluated further in the future.

Index Terms—Orthokeratology, Visual Acuity, Long-Term Effects.

I. INTRODUCTION

Advances in modern science and technology have led to the invention of various sound- and light-based entertainment devices; however, such devices can cause the visual acuity of children who use them for extended periods to deteriorate. No simple resolutions for this problem exist, with parents limited to reducing their children's use of such devices, having them live in natural environments, having them receive treatment from optometrists, applying mydriasis in their eyes, and having them wear orthokeratology lenses. One of the authors of this study received eye treatment as a child in the form of applying mydriasis. However, improvement was minimal. Later, said author tried wearing orthokeratology lenses, which led to favorable results. However, these lenses caused several side effects, such as wearing discomfort, diplopia, and dry eyes. Said author then stopped wearing orthokeratology lenses when entering high school. Thus, to determine whether wearing orthokeratology lenses restored visual acuity and related issues (e.g., whether the corneas were fully restored after wearing these lenses and if wearing these lenses prevented the wearers from requiring laser refractive surgery in the future), this study investigated the experience of users in wearing orthokeratology lenses, their subsequent visual acuity, and their opinions on said lenses.

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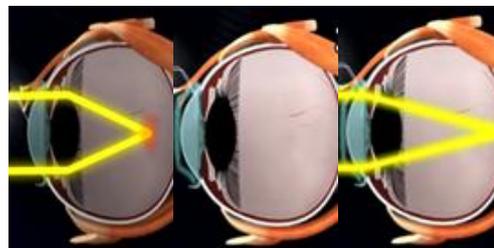
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II. LITERATURE REVIEW

Orthokeratology Lenses

The word "orthokeratology" is made up of the Greek words "ortho," "kerato," and "logy" and is commonly referred to as "ortho-k," with orthokeratology lenses known as "OK lenses" [1]. Orthokeratology lenses are hard lenses that push the epithelia in the middle of the corneas to the peripheries to ensure that images are focused in front of the retinae and optical axis lengthening is avoided, thereby ameliorating nearsightedness [2]. Because the central corneas are flattened after wearing orthokeratology lenses, the true nearsightedness and astigmatism of people who have worn them are difficult to measure. In general, visual acuity checks for such people entail checking their visual acuity after wearing the lenses [3].



Source: Wen-Fu Li. (2015). The doctor tells you if the Orthokeratology works. Apple Daily News. Oct. 08, 2015[4].

Long-Term Effects of Wearing Orthokeratology Lenses

The long-term effects of wearing orthokeratology lenses include and unpredictable changes in corneal shapes and functions. One study documented residual corneal flattening among 28 orthokeratology lens wearers, but the effects of residual corneal flattening remained indeterminate [5]. The study found that corneal curvature may return to its baseline if wearers wear orthokeratology lenses for long periods. Nonetheless, stromal cell reorganization may occur.

Another study investigated 17 participants (aged 21–33 years and who wore orthokeratology lenses) by using relevant instruments and measuring their corneal sensation pretreatment and three months post treatment [6]. The results revealed that their corneal sensation was significantly reduced after wearing said lenses, although the long-term effects of the sensation reduction were unclear. Thus, further studies that explore the long-term effects of orthokeratology lenses on the health and morphological changes of the corneas are necessary.



One study examined a 41-year-old Caucasian woman who had worn orthokeratology lenses for 13 years previously and who considered receiving laser refractive surgery after she stopped wearing them [7]. The study found that corneal topographic parameters did not return to their original values until 408 days after she stopped wearing the lenses, indicating that people who wear orthokeratology lenses must stop wearing them before receiving laser refractive surgery, although the period from when they cease wearing to when they can undergo surgery differs between people. The participant in the study was recommended to stop wearing these lenses for at least 1 year before being considered suitable for laser refractive surgery.

One study compared the responses of soft contact lens wearers with orthokeratology lens wearers post laser refractive surgery, with the results revealing no differences [8]. The study found that orthokeratology lenses do not alter corneal biomechanics or impair the effects of laser refractive surgery. However, the study was a pilot study, and subsequent changes in the study participants must be assessed in the future.

III. RESEARCH METHOD

This study adopted a quantitative survey research method, with a questionnaire that was developed based on the said author's past orthokeratology-wearing experiences and possible concerns that arise from wearing these lenses. Convenience sampling was adopted, which involved the authors creating an orthokeratology lens Facebook group, uploading the questionnaire, and asking volunteers who joined the group to fill out and return the questionnaire. Analysis was performed on the questionnaire results to obtain the study findings, on the basis of which recommendations are provided.

Questionnaire Content

The questionnaire employed in this study comprised three parts. The first part investigated the background of the participants who wore orthokeratology lenses, such as whether their nearsightedness had worsened, their medical treatment, and their personal opinions on orthokeratology lenses. The second part explored the problems of wearing orthokeratology lenses, such as discomfort and the effect of wearing them on sleep quality. The third part examined the potential problems after the participants stopped wearing orthokeratology lenses, such as their short-term experiences of not wearing the lenses and differences in visual acuity as tested through machine and human examinations. The questions were as follows:

The first part –

1. Did your nearsightedness worsen after wearing orthokeratology lenses?
2. Have you seen a doctor for related symptoms while wearing orthokeratology lenses?
3. Did your visual acuity improve the longer that you wore orthokeratology lenses?
4. When your nearsightedness worsened, did you think that you should change your orthokeratology lenses or increase the amount of time that you wore them?

The second part –

5. Did wearing orthokeratology lenses affect your sleep quality?
6. Did wearing orthokeratology lenses at night cause any discomfort in your eyes during the day?
7. How did your eyes feel after you wore orthokeratology lenses and went to sleep late?

The third part –

8. Does wearing glasses instead of orthokeratology lenses for a short period of time cause any problems?
9. Do your visual acuity and cornea degenerate if you stop wearing orthokeratology lenses for a long period?
10. After you stop wearing orthokeratology lenses, do machine and human examinations produce varying visual acuity results?

IV. RESULTS

A total of 9 responses were collected, with the results presented in pie charts in Figs. 1 to 10.

The first part –

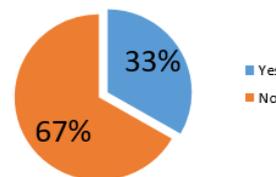


Figure 1 Did your nearsightedness worsen after wearing orthokeratology lenses?

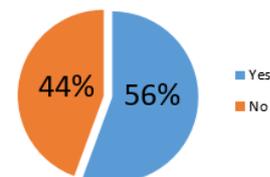


Figure 2 Have you seen a doctor for related symptoms while wearing orthokeratology lenses?

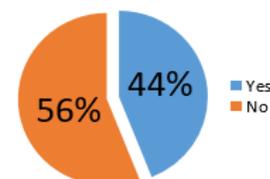


Figure 3 Did your visual acuity improve the longer that you wore orthokeratology lenses?

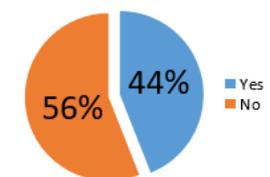


Figure 4 When your nearsightedness worsened, did you think that you should change your orthokeratology lenses or increase the amount of time that you wore them?

The second part –

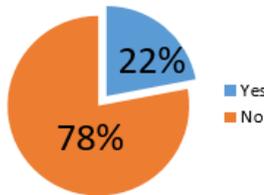


Figure 5 Did wearing orthokeratology lenses affect your sleep quality?

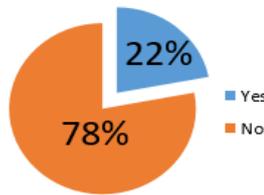


Figure 6 Did wearing orthokeratology lenses at night cause any discomfort in your eyes during the day?

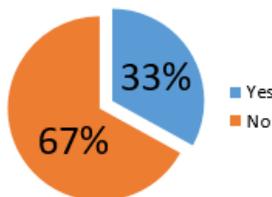


Figure 7 How did your eyes feel after you wore orthokeratology lenses and went to sleep late?

The third part -

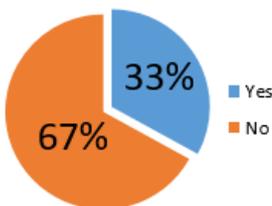


Figure 8 Does wearing glasses instead of orthokeratology lenses for a short period of time cause any problems?

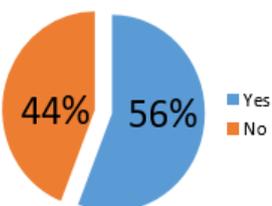


Figure 9 Do your visual acuity and cornea degenerate if you stop wearing orthokeratology lenses for a long period?

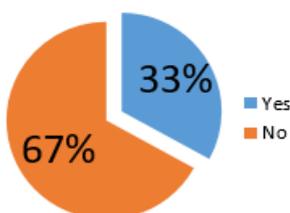


Figure 10 After you stop wearing orthokeratology lenses, do machine and human examinations produce varying visual acuity results?

V. DISCUSSION

The answers to the questions in Part 1 showed that approximately 30% of the participants' nearsightedness worsened even after wearing orthokeratology lenses; nearly 60% of them had seen a doctor for related symptoms while wearing orthokeratology lenses; and more than 40% of them believed that visual acuity would improve the longer that they wore the lenses. Moreover, approximately 20% would increase the amount of time that they wore these lenses if their nearsightedness worsened, whereas the remaining nearly 80% would change their lenses.

The answers to the questions in Part 2 indicated that more than 20% of the participants felt that wearing orthokeratology lenses had an effect on their sleep quality; approximately 20% of them felt discomfort in their eyes during the day after wearing orthokeratology lenses; and nearly 70% of them experienced discomfort in their eyes if they wore orthokeratology lenses and went to sleep late.

The answers to the questions in Part 3 revealed that for more than 30% of the participants, wearing glasses instead of orthokeratology lenses for a short period would create problems; nearly 60% of them maintained that visual acuity and the cornea would degenerate if they stopped wearing orthokeratology lenses for a long period; and more than 30% of them discovered that after they stopped wearing orthokeratology lenses, machine and human examinations produced varying visual acuity results.

The analysis results are consistent with those regarding the long-term effects of wearing orthokeratology lenses as described in the Literature Review section. For example, nearly 60% of the participants felt that visual acuity and the cornea would degenerate if they stopped wearing orthokeratology lenses for a long period, supporting the findings of Kang and Swarbrick [7] that orthokeratology lens wearers must stop wearing such lenses for at least 1 year before their corneal topographic parameters would return to their original values. More than 30% of the participants discovered that after they stopped wearing orthokeratology lenses, machine and human examinations produced varying visual acuity results, which supported the study by Wu et al. [5], who found that corneal curvature may return to its baseline if orthokeratology lenses are worn for longer periods. Nonetheless, stromal cell reorganization may occur.

Although studies have confirmed that wearing orthokeratology lenses has an immediate effect on ameliorating nearsightedness, the long-term effects on the health and morphological changes of the corneas must be evaluated further in the future.

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