

## Effects of Smile Myopia Correction on Stereo Vision and Ocular Biological Parameters

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**Keywords:** Smile myopia correction, Stereo vision, Ocular biological parameters, Effect

**Abstract:** SMILE correction has shown good safety, effectiveness, predictability and stability in the correction of myopia. So, in the process of clinical correction, how does it reflect the influence on stereo vision and ocular biological parameters is the focus of this paper. This paper focuses on the effects and changes of SMILE myopia correction on patients' stereo vision and ocular biological parameters, summarizes the effects and mechanisms of adjusting eye movement parameters and ocular biological restorability, verifies the mechanism of SMILE myopia correction, and provides a reference for clinical control of myopia correction effect.

### 1. Introduction

The incidence rate of myopia in China has been increasing in recent years, and the trend of young onset is very obvious. In this situation, new achievements have been made in the research of myopia correction. SMILE myopia correction has been welcomed by juvenile myopia patients in recent years. It has a good effect in postoperative recovery and myopia control. Meanwhile, it is ideal in terms of safety and noninvasive. However, there are still many uncertainties about the mechanism of SMILE myopia correction, and more research is needed to support the application of SMILE myopia correction <sup>[1]</sup>.

### 2. Overview of Smile Myopia Correction

SMILE surgery is to design and fabricate in the corneal stroma of the eye with femtosecond laser to form a complete lens, and the lens is taken through the mechanical separation technology of small incision. SMILE surgery does not need to make corneal flap, which is more minimally invasive than traditional minimally invasive surgery, and can better realize the relative integrity of corneal morphology, structure and function. It has been reported in the literature <sup>[2]</sup> that SMILE has good efficacy and safety in correcting myopia, but there is less analysis on the impact of patients' stereo vision and ocular biological parameters. For SMILE correction, it is mainly achieved by adjusting ocular diopter and sensitivity. SMILE correction is mainly completed through adjustment. It achieves the purpose of near vision by increasing the refractive power of the eyeball, relaxes the suspensory ligament, and meets the needs of shaping by contracting the ciliary muscle and lens, and convex the mirror. By adjusting the stimulus amount as the adjustment amount of the induced individual, and by seeing the quality of the object or visual target, it achieves the amount control. By realizing the adjustment response to minimize its own power, it can meet the purpose of small power for the eyes to complete the adjustment amount, so as to achieve the goal of clear vision. Therefore, the regulation of stimulus performance is to ensure that the regulation response can be lower than the regulation stimulus, so as to ensure the small quantification of regulation work. Because myopia is the regulation lag and the object forms a new focus imaging behind the retina. In this process, a large number of literatures have confirmed the relative existence of retinal defocus through animal experiments, and further clinical confirmation shows its existence. The persistent retinal defocus is an important internal mechanism leading to the occurrence and further

development of myopia<sup>[3]</sup>. The design of SMILE myopia correction can improve and reduce the adjustment lag. Yu Zhenhua, a health expert, believes that SMILE myopia correction has an obvious effect on improving the adjustment lag, and gradually tends to normalize it. Through comparison, some studies have proved that patients with low and moderate myopia are often the main force of myopia. What changes or advantages do they have after choosing SMILE myopia correction compared with wearing frame glasses before? Obviously, SMILE myopia correction can be better than the traditional frame glasses correction. In the design, SMILE myopia correction has significantly better safety and effect than frame glasses in terms of imaging quality, especially for the imaging quality of peripheral retina. SMILE myopia correction can well solve the problem of optical defocus. The object to be seen enters the refractive system through SMILE myopia correction. Unlike frame glasses, it can transmit a more accurate signal to the brain center to form feedback. After processing the information, the brain can send a more accurate signal, which is very important for regulating the response, can make the sensitivity better and improve the adjustment lag.

### 3. Application Analysis of Smile Myopia Correction

Preoperative examination is mainly routine examination, including @UCVA, near visual acuity, BCVA, natural pupil and mydriatic computer optometry, comprehensive optometry, pupil diameter, slit-lamp microscopic examination, ophthalmoscopy and post-mydriasis trihedroscopy, @IOLMaster ocular axis measurement and corneal horizontal diameter measurement, non-contact intraocular pressure and / or flattening intraocular pressure measurement, corneal fluorescein staining and tear film rupture time. Generally, Pentacam anterior segment image analysis system is used to measure corneal topography, corneal thickness, anterior chamber depth, lens density, etc. Contrast sensitivity test, WASCA aberration test are also included.

The operation process is basically completed by a doctor. Before operation, 0.4% obupivacaine hydrochloride eye drops should be drip 2 ~ 3 times for surface anesthesia. The eyeball should be attracted and fixed by non-flattened cone mirror under microscope. Yisumax femtosecond laser instrument is used for operation. The doctor will scan the rear surface of the lens, lens edge cutting, front surface of the lens (corneal cap) and small incision above the cornea successively. After laser scanning, the doctor will separate and take out the lens through the small incision. Lens, lens edge cutting and small incision edge cutting angle are designed during operation. Postoperative treatment and follow-up need to adhere to medication, such as Levofloxacin Eye Drops, Fluorometholone Eye Drops and Xinyanran Eye Drops.

1 day after operation, conventional slit-lamp microscope should be used to check the corneal condition, UCVA, BCVA, diopter and corneal topography. UCVA, BCVA, diopter, intraocular pressure, corneal topography and aberration should be followed up 1 month, 3 months, 6 months, 1 year and 2 years after operation.

According to the relevant literature, SMILE myopia correction performs well on the parameters of the above indexes.

The effect of SMILE myopia correction on the adjustment amplitude is the difference between the refractive power at the far point and the near point. SMILE myopia correction causes the change of human eye aberration, thus changing the adjustment clue, strengthening or weakening adjustment function accordingly. This change makes the adjustment goal more clear. SMILE myopia correction also has an impact on AC / A (AC / A refers to the ratio of regulatory convergence to regulation). The possible reasons for the reduction of high AC / A through SMILE myopia correction are as follows. Firstly, the retinal imaging quality has been significantly improved after operation, and can basically meet the role of improving vision after adjustment. Secondly, patients wearing frame glasses have lower demand for near vision adjustment than patients receiving SMILE myopia correction. Under the influence of fixed fusion image set, their demand is higher. In addition, the AC / A value of patients receiving SMILE myopia correction is lower. Therefore, in comparison, SMILE myopia correction has a great impact on the binocular visual function of myopia patients, and the use of SMILE myopia correction can improve the adjustment function of patients,

effectively reduce the abnormally high AC / A value, and coordinate the relationship between adjustment and convergence, so as to effectively control and reduce the incidence and development of myopia.

#### **4. Discussion on the Application of Smile Myopia Correction**

SMILE is realized by using femtosecond laser through accurate focusing and positioning technology. The specific process includes first performing two exploratory scans at different depths in the corneal stroma layer, cutting observation holes of a certain size, shaping a lens with a certain thickness, and then making a peripheral incision with an arc length of no more than 5mm at the edge of the lens in the stroma. The anterior and posterior surfaces of the lens are separated from the corneal tissue and taken out by the peripheral incision, so as to change the curvature of the cornea and achieve the effect of correcting myopia<sup>[4]</sup>.

Slight healing reaction can be observed in the early stage after SMILE, which makes the activities of corneal cells in each junction layer become active, and realizes the change of corneal fiber tissue in the junction layer with time. The small reflective particles will continue to exist. At 3 months, more changes will occur in the corneal subbasal nerve, and then recover to the preoperative level through regeneration. From early studies, it was found that the low myopia is not suitable for this kind of operation. Because the stromal lens for low myopia is relatively thin, it will form a superposition phenomenon on laser scanning. The additional heat will affect the success of the operation, because it will spread the heat to the surrounding corneal tissue and cause some complications, such as corneal edema. According to the existing literature and clinical data, the indicators of follow-up examination, UCVA, BCVA, diopter, intraocular pressure, corneal topography and aberration, at 1 month, 3 months, 6 months, 1 year and 2 years after SMILE all perform well. 1 year after SMILE, the effect of low myopia will come out faster, including higher security and stability.

The higher the degree of myopia, the more corneal stromal tissue removed and the thinner the remaining corneal tissue, which has a great impact on the postoperative corneal biomechanics. Therefore, it is also more prone to refractive regression. The refractive regression after SMILE is not only related to the high diopter corrected by surgery, but also related to the preoperative refractive instability and the control ability of teenagers, such as young age, thick Cap and thick removed lens. SMILE correction for high myopia requires more corneal tissue to be removed, and the risk of regression is higher. At the same time, it was found that 6 months after SMILE, the low and moderate myopia group tended to be flat, and the high myopia group showed a slight regression. At present, there are still some unknowns about the second surgical correction method of postoperative refractive regression in SMILE, which needs further research. Therefore, postoperative refractive regression should be avoided as far as possible. The degree of pre-correction can be appropriately increased in the preoperative operation design of patients with high myopia to prevent regression or under-correction after operation. For patients with thin cornea, low curvature and high degree and risk of regression, other refractive surgery can be considered<sup>[5]</sup>.

#### **5. Conclusion**

After several years of clinical practice, SMILE myopia correction has proved that it can better control and slow down the incidence of myopia. Especially for high-risk adolescents with myopia, it plays a positive role. For young students with relatively weak adjustment function, myopia patients can consider SMILE myopia correction.

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