Influence of Overnight Orthokeratology on Axial Elongation in Childhood Myopia

Tetsuhiko Kakita,[1] *Takahiro Hiraoka,*[2] *and Tetsuro Oshika*[1]

Purpose. This prospective study was conducted to assess the influence of overnight orthokeratology (OK) on axial elongation in children, with those wearing spectacles as controls.

Methods. One hundred five subjects (210 eyes) were enrolled in the study. The OK group comprised 45 patients (90 eyes, age 12.1 ± 2.5 years, mean ± SD; OK group) who matched the inclusion criteria for OK. The control group comprised 60 patients (120 eyes, 11.9 ± 2.0 years) who also matched the inclusion criteria for OK but preferred spectacles for myopia correction. Axial length was measured at baseline and after 2 years using ocular biometry, and the changes were evaluated and compared between the groups.

Results. Ninety-two subjects (42 and 50 in the OK and control groups, respectively) completed the 2-year follow-up examinations. At baseline, the spherical equivalent refractive error was −2.55 ± 1.82 and −2.59 ± 1.66 D, and the axial length was 24.66 ± 1.11 and 24.79 ± 0.80 mm in the OK and control groups, respectively, with no significant differences between the groups. The increase in axial length during the 2-year study period was 0.39 ± 0.27 and 0.61 ± 0.24 mm, respectively, and the difference was significant ($P < 0.0001$, unpaired *t*-test).

Conclusions. OK suppressed axial elongation in myopic children, suggesting that this treatment can slow the progression of myopia to a certain extent. (*Invest Ophthalmol Vis Sci.* 2011;52:2170–2174) DOI:10.1167/iovs.10-5485

Myopia is one of the most common ocular abnormalities in humans. The prevalence of myopia is reported to be between 25% and 30% in the developed countries,[1,2] with the incidence being higher among certain Asian populations (Lin LLK, et al. *IOVS* 1996;37:ARVO Abstract 4600). It is generally thought that progression of youth-onset myopia is attributable to axial elongation, which is not compensated for by reductions in the corneal and crystalline lens power.[3–6]

Myopia can be corrected by spectacles or contact lenses. However, these treatments do not solve the problem of ocular axial elongation. It is well known that myopia is often associated with sight-threatening complications, such as retinal detachment, macular degeneration, and glaucoma.[7–10] Furthermore, the risk of these complications increases with the severity of myopia and increased axial length.[10] Arresting the progression of this myopic condition and preventing accentuated myopia would therefore contribute to the prevention of these common ocular diseases and thus would likely have a very significant effect in reducing medical expenditures.

So far, the scientific community has been trying to find an effective means to slow or even arrest the development of myopia in children.[11] Several medical treatments have been tested, including topical application of tropicamide,[12] atropine,[13–15] pirenzepine,[16–18] and ocular hypotensive agents.[19,20] However, there have been no ideal therapeutic modalities to effectively prevent myopic progression in light of efficacy, safety, economic feasibility, and ease of application.

One previous report has described the effectiveness of overnight orthokeratology (OK) for arresting the progression of myopia in the left eye of a 13-year-old boy, in whom it was found that axial elongation was less in the left eye than in the right after 2 years.[21] This study showed the possibility that OK might be capable of suppressing ocular axial elongation in myopic children. Subsequently, Cho et al.[22] conducted a 2-year pilot study to determine whether OK could ameliorate the progression of myopia in children. The authors compared the growth of axial length in 35 children undergoing OK with that of 35 children wearing single-vision spectacles and reported that the increases in axial length were significantly smaller in the OK group than in the spectacles group. In that study, however, the data for the control group were obtained at other facilities, where axial length was measured using different devices.[23] Therefore, the study was not considered to have been adequately controlled. More recently, similar results have been confirmed by Walline et al.[24] However, theirs was also a nonrandomized study with an inappropriate control group that had been recruited from a different study.[25] In addition, axial length measurements were performed with a conventional contact type A-scan ultrasound device. In recent years, it has been shown that a laser interferometer (IOLMaster; Carl Zeiss Meditec, Dublin, CA) yields highly reproducible, precise, noncontact, and rapid axial length measurements with less burden on the patient.[26] Such features of the interferometer are considerably advantageous for repeated, longitudinal measurements of axial length in children.

We conducted the current prospective study using interferometry to find out how the continued use of OK affects axial growth in children. Children wearing spectacles and attending the same clinic were recruited as controls.

Methods

The survey was conducted between November 2002 and June 2007. Forty-five patients who matched the inclusion criteria (Table 1) were enrolled in the OK group. There were 22 boys and 23 girls, ranging in age from 8 to 16 (12.1 ± 2.5 [mean ± SD]) years. One hundred twenty eyes of 60 individuals served as controls. They also matched the inclusion criteria for OK but preferred spectacles to OK for the correction of myopia. The control group included 28 boys and 32 girls, ranging in age from 8 to 16 (11.9 ± 2.0) years.

The study was conducted in accordance with the tenets of the Declaration of Helsinki and approved by the Ethics Committee of

From the [1]Kakita Eye Clinic, Chiba, Japan; and the [2]Department of Ophthalmology, Institute of Clinical Medicine, University of Tsukuba, Ibaraki, Japan.

Submitted for publication March 6, 2010; revised May 19, July 2, September 16, and October 3 and 14, 2010; accepted October 27, 2010.

Disclosure: **T. Kakita**, None; **T. Hiraoka**, None; **T. Oshika**, None

Corresponding author: Tetsuhiko Kakita, Kakita Eye Clinic, 4-1-15, Minaminagareyama, Nagareyama, Chiba, 270-0163, Japan; kec@kakitaeyeclinic.com.

Investigative Ophthalmology & Visual Science, April 2011, Vol. 52, No. 5