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# Knowledge, Attitude, and Practice of Orthokeratology for Myopia Control Among Parents of Orthokeratology-Wearing Children

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**Background:** This study aimed to evaluate the knowledge, attitudes, and practices (KAP) of parents whose children wear orthokeratology lenses.

**Methods:** A cross-sectional study was conducted in the Ophthalmology Department at Beijing Hui People's Hospital from November 8 to 30, in 2024. Demographic data, along with KAP scores, were collected through a self-designed and expert-validated questionnaire administered to parents of children wearing orthokeratology lenses.

**Results:** A total of 499 valid questionnaires were included in the final analysis, with 426 (85.37%) participants being mothers. The mean duration of myopia in the children was 3.35 ± 2.05 years, while the mean duration of orthokeratology lens use was 2.68 ± 1.74 years. The mean scores for knowledge, attitude, and practice were 7.89 ± 1.44 (range: 0–11), 41.95 ± 3.06 (range: 10–50), and 32.68 ± 3.46 (range: 8–40), respectively. Structural equation modeling (SEM) demonstrated significant direct effects of knowledge on both attitude ($\beta = 0.370$, $P = 0.004$) and practice ($\beta = 1.623$, $P < 0.001$), as well as a significant effect of attitude on practice ($\beta = 0.622$, $P < 0.001$).

**Conclusion:** Parents of children using orthokeratology lenses generally exhibited adequate knowledge, positive attitudes, and proactive practices related to lens care. These findings suggest that strengthening parental education—especially among those without a medical background—may be a viable strategy to enhance orthokeratology care and support children's visual health.

**Keywords:** orthokeratology, myopia, knowledge, attitude, practice, parental education, visual health

## Introduction

Myopia is one of the most prevalent eye conditions globally, affecting approximately two billion people, or 28.3% of the world's population.[1–4] In China, the prevalence is particularly high, with over 60% of 12-year-olds, nearly 80% of 16-year-olds, and more than 90% of college students affected.[5–7] Orthokeratology (Ortho-K) involves the planned use of specially designed rigid lenses to temporarily reshape the cornea and slow myopia progression in children. It is widely regarded as an effective and reversible approach for myopia control.[8–10] However, similar to conventional contact lenses, Ortho-K use carries a potential risk of infection, particularly microbial keratitis, if hygiene and lens care are inadequate. Such risks can be minimized through proper cleaning, regular follow-up, and strict adherence to professional fitting and care instructions.[11]

The knowledge, attitude, and practice (KAP) survey is an established diagnostic tool that provides insights into a population's understanding, beliefs, and behaviors regarding a specific topic, particularly in health literacy. The Knowledge, Attitude, and Practice (KAP) model is founded on the idea that knowledge shapes attitude, which then influence behavior, and is thus highly relevant in assessing and improving health-related practice.[12–14] In the context of orthokeratology, this framework is particularly valuable because children depend on their parents for lens cleaning, handling, and compliance with follow-up schedules. Therefore, parents' KAP directly determines whether orthokeratology can be used safely and effectively. Since most Ortho-K wearers are children or adolescents, the decision to initiate treatment is typically made by parents.[15] Understanding parents' knowledge, attitude, and practice (KAP) toward

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orthokeratology is therefore crucial, as it directly affects treatment adherence, timely follow-up, and the prevention of complications. Previous KAP studies in ophthalmology, such as those investigating parental awareness and compliance in amblyopia or myopia management, have shown that higher parental health literacy is associated with improved clinical outcomes and reduced adverse events.[11] For younger children, who often require parental assistance with lens handling and care (eg, insertion, removal, and cleaning), parental involvement is crucial. Parents' knowledge about Ortho-K, their motivations for choosing this treatment, and their concerns can greatly influence both the efficacy and safety of the treatment. Thus, understanding parental perspectives can aid practitioners in enhancing communication, addressing misconceptions, and minimizing risks associated with improper lens handling or insufficient follow-up.[16]

Although several studies have examined clinical outcomes and risk factors of orthokeratology, few have focused on parents' perspectives, including their understanding, attitudes, and actual practices in daily lens care. This lack of evidence limits our ability to design targeted educational programs for families using orthokeratology.[17] This study aims to systematically assess parents' knowledge, attitude, and practice regarding Ortho-K through quantitative and qualitative approaches. By identifying challenges parents encounter with Ortho-K use, this study will inform the development of targeted educational interventions to improve treatment outcomes. The findings will support best practice in myopia control for children and provide a foundation for future research in this field.

# Materials and Methods

## Study Design and Participants

This cross-sectional study was conducted in the Ophthalmology Department at Beijing Hui People's Hospital from November 8 to 30, in 2024, targeting parents of children who wear orthokeratology lenses. This three-week period (November 8–30, 2024) was selected to coincide with the hospital's routine orthokeratology follow-up schedule, which typically occurs at the end of each academic semester. This ensured consistent participant recruitment and minimized potential recall and seasonal bias. Ethical approval was obtained from the Beijing Hui People's Hospital Ethics Committee (Approval No.20240027), and informed consent was obtained from all participants. The inclusion criteria required that the participants were parents aged 18 years or older whose children had been wearing orthokeratology lenses for at least three months of regular use. Eligible parents were those able to understand the study's purpose and willing to provide informed consent. Only parents of children who used Ortho-K lenses regularly and attended routine follow-up visits at our ophthalmology clinic were included. In our clinical setting, regular use refers to overnight wear for approximately 6–10 hours every night. The typical lifespan of an Ortho-K lens is about one and a half to two years, depending on axial length progression and the physical condition of the lens. During the study period, participants were recruited consecutively from the ophthalmology outpatient department. The exclusion criteria covered individuals unable to complete the questionnaire independently due to cognitive impairment or other conditions. This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline, and the completed STROBE checklist is provided as Supplementary File 1.

## Questionnaire Introduction

The questionnaire was developed based on a review of previous literature and relevant guidelines from both domestic and international sources.

Step 1: Development — The initial draft included four sections covering demographic characteristics and KAP dimensions.

Step 2: Expert Review — Two specialists in pediatric keratoconus and myopia prevention evaluated the relevance, representativeness, and clarity of all items. Their feedback ensured the content validity of the questionnaire and guided further refinement.

Step 3: Pilot Testing — The revised version was pretested among 30 parents of children wearing orthokeratology lenses to examine item comprehension and applicability. Minor wording adjustments were made according to participant feedback, thereby ensuring the face validity of the instrument.

Step 4: Reliability Assessment — The final questionnaire demonstrated good internal consistency, with a Cronbach's alpha of 0.769.

Step 5: Final Version — The validated Chinese version was then used for formal data collection. The finalized questionnaire, in Chinese, consisted of four sections: demographic information, knowledge, attitude, and practice. The knowledge section included 11 items, with correct answers awarded 1 point and incorrect or "unsure" responses given 0 points, yielding a possible score range of 0–11. The attitude section comprised 10 questions rated on a five-point Likert scale from "strongly agree" to "strongly disagree," scored from 5 to 1, for a total score range of 10–50. One of the attitude items (A4) specifically assessed parental concern about the potential risks of orthokeratology lenses. In addition, one item in the knowledge section (K9) assessed awareness of corneal complications as a common risk associated with Ortho-K wear. The practice section contained 8 questions, with responses ranging from "never" to "always," scored from 1 to 5, yielding a total score range of 8–40. A score threshold of ≥70.0% was used to define good knowledge, positive attitude, and proactive behaviors.[18,19]

## Questionnaire Distribution and Quality Control

The questionnaire was distributed through both online and offline channels to enhance participation and accessibility. Offline, paper-based questionnaires were distributed in the ophthalmology outpatient department and collected on-site upon completion. Trained personnel oversaw the distribution, collection, data entry, and verification procedures to ensure data accuracy and consistency. The online questionnaire was imported using the *Sojump* platform (https://www.wjx.cn/). Participants accessed the questionnaire by scanning a QR code available in the outpatient clinic or through a WeChat group. The research team, consisting of four trained research assistants, was responsible for promoting and distributing the questionnaire. They meticulously reviewed all submissions for completeness, internal consistency, and logical coherence. Any submissions containing logical discrepancies, incomplete answers, or identical responses across all items were classified as invalid.

## Statistical Analysis

Data analysis was conducted using Statistical Package for the Social Sciences (SPSS) version 27.0 (IBM, Armonk, NY, USA) and Analysis of Moment Structures (AMOS) version 26.0 (IBM, Armonk, NY, USA). Demographic characteristics and KAP scores were analyzed descriptively, with continuous data presented as mean ± standard deviation (SD) and categorical data expressed as frequencies and percentages n (%). Group differences in awareness, attitude, and practice scores were assessed using *t*-tests for two-group comparisons and analysis of variance (ANOVA) for comparisons involving three or more groups, assuming normal distribution of continuous variables. Pearson's correlation coefficient was used to evaluate relationships between scores in each KAP dimension. Structural equation modeling (SEM) was conducted to assess the hypotheses that knowledge directly affects both attitude and practice, and that attitude directly affects practice. Model fit was evaluated using the following criteria: root mean square error of approximation (RMSEA) $< 0.08$, standardized root mean square residual (SRMR) $< 0.08$, Tucker-Lewis index (TLI) $> 0.8$, and comparative fit index (CFI) $> 0.8$. A two-sided P-value $< 0.05$ was considered statistically significant.

# Results

## Demographic Characteristics on the Population

A total of 501 questionnaires were initially collected for this study; however, two questionnaires were excluded due to errors in trap questions, resulting in 499 valid responses. Among the participants, 426 (85.37%) were mothers, with a mean age of 43.99 ± 4.91 years. The majority of participants, 396 (79.36%), held an associate or bachelor's degree, and 429 (85.97%) were myopic. The children had an average age of 12.90 ± 2.83 years, had been myopic for an average of 3.35 ± 2.05 years, and had been using orthokeratology lenses for an average of 2.68 ± 1.74 years. Additionally, 237 (47.49%) of the families reported an annual expenditure of 10,000 to 15,000 Yuan on orthokeratology lenses. The mean score of knowledge, attitude and practice were 7.89 ± 1.44 (range: 0–11), 41.95 ± 3.06 (range: 10–50), and 32.68 ± 3.46 (range: 8–40), respectively. Knowledge scores differed significantly based on factors such as residence ($P < 0.001$),

monthly income per capita (P < 0.001), myopic status (P = 0.020), relationship to the child (P = 0.036), annual expenditure on orthokeratology lenses (P = 0.028), and who was responsible for lens care (P < 0.001). Attitude scores varied significantly by residence (P = 0.009), medical profession (P < 0.001), and lens care responsibility (P < 0.001). Practice scores showed significant differences based on gender (P < 0.001), education level (P = 0.001), monthly income per capita (P < 0.001), medical profession (P < 0.001), relationship to the child (P < 0.001), annual expenditure on orthokeratology lenses (P = 0.025), daily duration of lens wear (P < 0.001), best visual acuity after lens use (P = 0.023), and lens care responsibility (P < 0.001) (Table 1).

**Table 1** Demographic Characteristics and KAP Scores

| | N (%) | Knowledge | | Attitude | | Practice | |
|---|---|---|---|---|---|---|---|
| | | Mean ± SD | P | Mean ± SD | P | Mean ± SD | P |
| **Total** | 499 | 7.89 ± 1.44 | | 41.95 ± 3.06 | | 32.68 ± 3.46 | |
| **Gender** | | | 0.091 | | 0.481 | | <0.001 |
| Male | 62 (12.42) | 7.60 ± 1.86 | | 41.69 ± 3.90 | | 30.98 ± 4.76 | |
| Female | 437 (87.58) | 7.93 ± 1.36 | | 41.99 ± 2.92 | | 32.92 ± 3.17 | |
| **Age (years)** | 43.99 ± 4.91 | | | | | | |
| **Residence** | | | <0.001 | | 0.009 | | 0.062 |
| Rural | 5 (1.00) | 5.60 ± 3.58 | | 38.40 ± 3.36 | | 29.80 ± 3.03 | |
| Urban | 494 (99.00) | 7.91 ± 1.39 | | 41.99 ± 3.04 | | 32.70 ± 3.45 | |
| **Education** | | | 0.151 | | 0.558 | | 0.001 |
| High school/technical school | 10 (2.00) | 8.60 ± 1.35 | | 42.90 ± 5.59 | | 35.50 ± 4.01 | |
| Associate degree/bachelor's degree | 396 (79.36) | 7.84 ± 1.47 | | 41.90 ± 2.90 | | 32.81 ± 3.24 | |
| Master's degree and above | 93 (18.64) | 8.02 ± 1.28 | | 42.05 ± 3.38 | | 31.78 ± 4.04 | |
| **Occupation** | | | 0.890 | | 0.394 | | 0.280 |
| Full-time employee/part-time employee/freelancer | 465 (93.19) | 7.89 ± 1.43 | | 41.92 ± 3.03 | | 32.63 ± 3.46 | |
| Others | 34 (6.81) | 7.85 ± 1.5 | | 42.38 ± 3.48 | | 33.29 ± 3.35 | |
| **Monthly income per capita** | | | <0.001 | | 0.103 | | <0.001 |
| <10,000 | 62 (12.42) | 6.71 ± 2.21 | | 42.63 ± 4.47 | | 31.71 ± 3.84 | |
| 10,000–20,000 | 368 (73.75) | 8.13 ± 1.09 | | 41.92 ± 2.56 | | 33.26 ± 2.89 | |
| >20,000 | 69 (13.83) | 7.62 ± 1.65 | | 41.51 ± 3.81 | | 30.42 ± 4.63 | |
| **Medical professional** | | | 0.138 | | <0.001 | | <0.001 |
| Yes | 82 (16.43) | 7.67 ± 1.68 | | 43.52 ± 3.29 | | 31.40 ± 4.47 | |
| No | 417 (83.57) | 7.93 ± 1.38 | | 41.64 ± 2.92 | | 32.93 ± 3.17 | |
| **Are you myopic** | | | 0.020 | | 0.628 | | 0.292 |
| Yes | 429 (85.97) | 7.95 ± 1.41 | | 41.92 ± 3.02 | | 32.74 ± 3.33 | |
| No | 70 (14.03) | 7.51 ± 1.58 | | 42.11 ± 3.33 | | 32.27 ± 4.15 | |
| **Used of orthokeratology lenses** | | | 0.185 | | 0.354 | | 0.064 |
| Yes | 28 (5.61) | 7.54 ± 1.48 | | 41.43 ± 3.94 | | 31.50 ± 4.00 | |
| No | 471 (94.39) | 7.91 ± 1.43 | | 41.98 ± 3.00 | | 32.75 ± 3.42 | |
| **Relation with the child** | | | 0.036 | | 0.782 | | <0.001 |
| Father | 54 (10.82) | 7.44 ± 1.87 | | 41.87 ± 3.81 | | 30.63 ± 4.68 | |
| Mother | 426 (85.37) | 7.95 ± 1.31 | | 41.94 ± 2.88 | | 32.92 ± 3.17 | |
| Others | 13 (2.61) | 7.63 ± 2.41 | | 42.42 ± 4.49 | | 33.00 ± 3.69 | |
| **Child's age (years)** | 12.90 ± 2.83 | | | | | | |
| **Child's degree of myopia** | | | | | | | |
| Left eye | 223.45 ± 119.40 | | | | | | |
| Right eye | 237.93 ± 121.31 | | | | | | |

(*Continued*)

**Table 1** (Continued).

| | N (%) | Knowledge | | Attitude | | Practice | |
|---|---|---|---|---|---|---|---|
| | | Mean ± SD | P | Mean ± SD | P | Mean ± SD | P |
| **Duration of myopic (years)** | 3.35 ± 2.05 | | | | | | |
| **Duration of wearing orthokeratology lenses (years)** | 2.68 ± 1.74 | | | | | | |
| **Spending on orthokeratology lenses annually** | | | 0.028 | | 0.472 | | 0.025 |
| <10,000 | 112 (22.44) | 7.79 ± 1.70 | | 42.14 ± 3.10 | | 32.17 ± 4.43 | |
| 10,000–15,000 | 237 (47.49) | 7.75 ± 1.53 | | 41.84 ± 3.14 | | 32.49 ± 3.25 | |
| 15,000–20,000 | 130 (26.05) | 8.21 ± 0.93 | | 42.12 ± 2.72 | | 33.43 ± 2.58 | |
| >20,000 | 20 (4.01) | 7.90 ± 1.12 | | 41.15 ± 3.87 | | 32.80 ± 4.03 | |
| **Duration of wearing the orthokeratology lenses each day** | | | 0.051 | | 0.848 | | <0.001 |
| < 7h | 84 (16.83) | 7.64 ± 1.81 | | 42.24 ± 3.46 | | 31.88 ± 4.02 | |
| 7–8h | 151 (30.26) | 7.72 ± 1.49 | | 42.03 ± 2.97 | | 32.11 ± 3.48 | |
| 8–9h | 159 (31.86) | 8.01 ± 1.36 | | 41.84 ± 3.25 | | 32.89 ± 3.47 | |
| 9–10h | 88 (17.64) | 8.18 ± 1.08 | | 41.77 ± 2.59 | | 33.99 ± 2.51 | |
| > 10h | 17 (3.41) | 7.94 ± 0.90 | | 41.82 ± 2.24 | | 32.88 ± 2.20 | |
| **Changes after wearing the orthokeratology lenses** | | | 0.141 | | 0.330 | | 0.066 |
| No significant change | 496 (99.40) | 7.89 ± 1.44 | | 41.94 ± 3.06 | | 32.65 ± 3.45 | |
| Worsened vision | 0 | - | | - | | - | |
| Improved vision | 3 (0.60) | 6.67 ± 0.58 | | 43.67 ± 1.53 | | 36.33 ± 2.89 | |
| **Best visual acuity after wearing the lenses** | | | 0.180 | | 0.354 | | 0.023 |
| <1.0 | 267 (53.51) | 7.97 ± 1.34 | | 41.83 ± 2.71 | | 33.00 ± 2.93 | |
| ≥1.0 | 232 (46.49) | 7.79 ± 1.54 | | 42.09 ± 3.42 | | 32.30 ± 3.95 | |
| **Axial length stable after wearing the lenses** | | | 0.159 | | 0.121 | | 0.489 |
| Yes | 466 (93.39) | 7.91 ± 1.42 | | 42.01 ± 3.05 | | 32.70 ± 3.45 | |
| No | 33 (6.61) | 7.55 ± 1.60 | | 41.15 ± 3.12 | | 32.27 ± 3.61 | |
| **See clearly throughout the day after wearing the lenses** | | | 0.060 | | 0.234 | | 0.125 |
| Yes | 474 (94.99) | 7.91 ± 1.36 | | 41.99 ± 3.02 | | 32.73 ± 3.41 | |
| No | 25 (5.01) | 7.36 ± 2.43 | | 41.24 ± 3.65 | | 31.64 ± 4.15 | |
| **People for removing and caring for the lenses** | | | <0.001 | | <0.001 | | <0.001 |
| Father | 22 (4.41) | 6.59 ± 2.84 | | 41.68 ± 4.21 | | 30.77 ± 4.21 | |
| Mother | 368 (73.75) | 8.00 ± 1.20 | | 41.68 ± 2.70 | | 33.15 ± 2.93 | |
| The child | 109 (21.84) | 7.75 ± 1.62 | | 42.91 ± 3.71 | | 31.46 ± 4.42 | |

## Knowledge, Attitude, and Practice Dimensions

Table 2 summarizes the overall scores and achievement levels for parental knowledge, attitude, and practice. Based on the threshold of ≥70.0% of the total score, 179 (35.87%) parents had adequate knowledge, 348 (69.74%) had a positive attitude, and 299 (59.92%) demonstrated proactive practice.

In the knowledge dimension, the three items with the lowest accuracy were: “Pregnant or breastfeeding women can wear orthokeratology lenses” (K4) with 23.45%, “Corneal staining is the most common complication of wearing orthokeratology lenses” (K9) with 55.71%, and “At least 8 hours of sleep with the lenses is required before a follow-up” (K11) with 68.14%. Regarding attitude, 15.43% of participants expressed concern about the potential risks of orthokeratology lenses in the A4 item, while 26.65% were unconcerned, and a majority of 56.11% were neutral. For

**Table 2** A Comprehensive Summary Table

| KAP Dimension | Total Possible Score | Score (Mean ± SD) | Mean Score (%)[A] | Participants at Adequate Level (n, %)[B] | Key Deficiencies (Lowest Accuracy/Performance Items) |
|---|---|---|---|---|---|
| **Knowledge** | 11 | 7.89 ± 1.44 | 71.7% | 179 (35.87%) | Contraindications (K4: 23.45%), Complications (K9: 55.71%) |
| **Attitude** | 50 | 41.95 ± 3.06 | 83.9% | 348 (69.74%) | Neutral stance on risks (A4: 56.11% neutral) |
| **Practice** | 40 | 32.68 ± 3.46 | 81.7% | 299 (59.92%) | Improper procedures (P2), Non-adherence to prescription (P3) |

**Notes**: [A] Mean Score (%) = (Mean Score/Total Possible Score) × 100. [B] Based on the manuscript's definition: score ≥70% of the total possible score (Knowledge ≥8, Attitude ≥35, Practice ≥28).

practice, 3.41% of children always, and 7.62% often, reported eye discomfort while wearing the lenses (P1). Meanwhile, 2.40% always and 2.2% often showed improper lens removal, application, or care (P2). Additionally, 7.82% never followed the doctor's prescription for orthokeratology lens treatment (P3) (Table 3).

## Correlations Analysis

Correlation analysis showed significant positive relationships between knowledge and attitude scores ($r = 0.152$, $P < 0.001$), knowledge and practice scores ($r = 0.308$, $P < 0.001$), and attitude and practice scores ($r = 0.254$, $P < 0.001$) (Table 4).

## Univariate and Multivariate Analysis of Practice Dimension

Multivariate logistic regression indicated that knowledge score (OR = 1.300, 95% CI: [1.102, 1.534], P = 0.002), attitude score (OR = 1.157, 95% CI: [1.077, 1.244], P < 0.001), being medical professional (OR = 0.380, 95% CI: [0.203, 0.712], P = 0.003), and wearing the orthokeratology lenses for 9–10h each day (OR = 2.375, 95% CI: [1.127, 5.002], P = 0.023) were independently associated with proactive practice (Table 5).

## SEM Analysis

The SEM demonstrated highly favorable model fit indices (CMIN/DF value: 2.038, RMSEA value: 0.046, IFI value: 0.826, TLI value: 0.802, and CFI value: 0.822), suggesting a well-fitting model (Table 6), and the results showed a the direct effect of knowledge on both attitude ($\beta = 0.370$, $P = 0.004$) and practice ($\beta = 1.623$, $P < 0.001$), as well as of attitude on practice ($\beta = 0.622$, $P < 0.001$) (Table 7 and Figure 1).

# Discussion

This study aimed to examine the interrelationships among parents' knowledge, attitudes, and practices (KAP) regarding their children's use of orthokeratology lenses. The discussion focuses on how parental knowledge and attitudes influence actual care practices, in line with the predefined objectives. Overall, most parents showed a sound understanding of lens care and displayed responsible behaviors in managing their children's Ortho-K use. Strengthening education among non-medical parents could further enhance compliance and help prevent complications associated with inadequate care. Assessing parents' knowledge and attitudes is essential for identifying potential gaps that may compromise their children's safety in using orthokeratology lenses. Parents who are well informed about lens hygiene, proper wear duration, and the importance of regular follow-ups are better equipped to minimize the risks of infection and corneal ulcers.

The primary findings of this study suggest that parents of children who wear orthokeratology lenses generally display adequate knowledge, positive attitude, and proactive practice related to lens care. However, specific demographic factors such as income, residence, and medical background significantly impact KAP scores. This aligns with other studies where factors like socioeconomic status and occupational background have been shown to influence health-related KAP, with more informed groups typically engaging in safer, more proactive health behaviors.[20] For example, studies have shown that parents with healthcare experience or higher income are more likely to practice good health-related habits due

**Table 3** Distribution of Knowledge, Attitude, and Practice Dimension

| Knowledge Dimension | Accuracy n (%) |
|---|---|
| 1. **The principle of orthokeratology lenses is a clinical correction method that temporarily reduces myopia by flattening the curvature of the central cornea within a certain range after wearing the lenses.** | 468 (93.79) |
| 2. **There is no age limit for wearing orthokeratology lenses.** | 402 (80.56) |
| 3. **People with acute or chronic eye inflammation should not wear orthokeratology lenses.** | 488 (97.80) |
| 4. **Pregnant or breastfeeding women can wear orthokeratology lenses.** | 117 (23.45) |
| 6. **People wearing orthokeratology lenses must undergo regular follow-up check-ups.** | 495 (99.20) |
| 7. **After stopping the use of orthokeratology lenses, the myopia degree will gradually rebound, and the cornea will return to its pre-lens state.** | 454 (90.98) |
| 8. **Corneal topography during eye exams is crucial for fitting orthokeratology lenses, as it helps identify unsuitable patients whose corneas are conical, dome-shaped, or irregular.** | 407 (81.56) |
| 9. **Corneal staining is the most common complication of wearing orthokeratology lenses.** | 278 (55.71) |
| 10. **Proper care procedures are very important, as they can achieve better correction results and reduce the occurrence of complications.** | 486 (97.39) |
| 11. **On the night before a follow-up, at least 8 hours of sleep wearing the lenses is required.** | 340 (68.14) |

| Attitude dimension | Strongly agree n (%) | Agree n (%) | Neutral n (%) | Disagree n (%) | Strongly disagree n (%) |
|---|---|---|---|---|---|
| 1.**You believe that orthokeratology lenses can significantly improve your child's myopia.** | 201 (40.28) | 227 (45.49) | 64 (12.83) | 5 (1.00) | 2 (0.40) |
| 2. **You believe that orthokeratology lenses can slow down the progression of your child's myopia.** | 210 (42.08) | 280 (56.11) | 7 (1.4) | 0 | 2 (0.40) |
| 3. **You believe that orthokeratology lenses are currently a mature and reliable optical intervention technique in clinical practice.** | 150 (30.06) | 285 (57.11) | 63 (12.63) | 1 (0.20) | 0 |
| 4. **You believe that there are potential risks associated with orthokeratology lenses and are very concerned about them.** | 0 | 77 (15.43) | 280 (56.11) | 133 (26.65) | 9 (1.80) |
| 5. **You believe it is very important for doctors to demonstrate proper handwashing, lens removal, lens application, and lens cleaning procedures to wearers and guardians, and provide necessary explanations.** | 368 (73.75) | 127 (25.45) | 4 (0.80) | 0 | 0 |
| 6. **You are highly satisfied with the current results of your child wearing orthokeratology lenses.** | 186 (37.27) | 279 (55.91) | 34 (6.81) | 0 | 0 |
| 7. **You believe that your child is highly cooperative in wearing orthokeratology lenses.** | 152 (30.46) | 290 (58.12) | 56 (11.22) | 1 (0.20) | 0 |
| 8. **You believe that proper lens care helps reduce the occurrence of complications.** | 348 (69.74) | 143 (28.66) | 8 (1.60) | 0 | 0 |
| 9. **You believe that regular follow-up check-ups are very important.** | 229 (45.89) | 266 (53.31) | 2 (0.40) | 2 (0.40) | 0 |
| 10. **You believe that wearing orthokeratology lenses depends more on the parents' involvement rather than the child's.** | 96 (19.24) | 232 (46.49) | 73 (14.63) | 93 (18.64) | 5 (1.00) |

| Practice dimension | Always n (%) | Often n (%) | Sometimes n (%) | Rarely n (%) | Never n (%) |
|---|---|---|---|---|---|
| 1. **Has your child ever complained about eye discomfort while wearing orthokeratology lenses?** | 17 (3.41) | 38 (7.62) | 130 (26.05) | 280 (56.11) | 34 (6.81) |
| 2. **Have you ever followed improper procedures for lens removal, application, or care?** | 12 (2.40) | 11 (2.20) | 70 (14.03) | 350 (70.14) | 56 (11.22) |
| 3. **Do you follow the doctor's prescription to help your child with orthokeratology lens treatment?** | 194 (38.88) | 202 (40.48) | 37 (7.41) | 27 (5.41) | 39 (7.82) |
| 4. **Do you regularly take your child for eye check-ups?** | 313 (62.73) | 116 (23.25) | 60 (12.02) | 10 (2.00) | 0 |
| 5. **Do you pay attention to your child's eye health, such as reducing screen time and encouraging outdoor activities?** | 258 (51.70) | 158 (31.66) | 73 (14.63) | 9 (1.80) | 1 (0.20) |
| 6. **If any issues arise while wearing orthokeratology lenses, do you seek professional medical support in a timely manner?** | 346 (69.34) | 126 (25.25) | 23 (4.61) | 4 (0.80) | 0 |
| 7. **Do you actively learn about orthokeratology lenses?** | 141 (28.26) | 237 (47.49) | 86 (17.23) | 35 (7.01) | 0 |
| 8. **Do you actively discuss your experiences with orthokeratology lenses and myopia prevention with doctors, family, or friends?** | 134 (26.85) | 206 (41.28) | 133 (26.65) | 26 (5.21) | 0 |

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**Table 4** Correlation Analysis

| | Knowledge | Attitude | Practice |
|---|---|---|---|
| **Knowledge** | 1 | | |
| **Attitude** | 0.152 (P<0.001) | 1 | |
| **Practice** | 0.308 (P<0.001) | 0.254 (P<0.001) | 1 |

**Table 5** Univariate and Multivariate Analysis for Practice Dimension

| | Univariate Regression | | Multivariate Regression | |
|---|---|---|---|---|
| | **OR (95% CI)** | **P** | **OR (95% CI)** | **P** |
| **Knowledge score** | 1.469 (1.270, 1.698) | <0.001 | 1.300 (1.102, 1.534) | 0.002 |
| **Attitude score** | 1.116 (1.050, 1.186) | <0.001 | 1.157 (1.077, 1.244) | <0.001 |
| **Gender** | | | | |
| Male | Ref. | | Ref. | |
| Female | 2.305 (1.343, 3.956) | 0.002 | 1.452 (0.225, 9.396) | 0.695 |
| **Age (years)** | 0.986 (0.951, 1.023) | 0.455 | | |
| **Residence** | | | | |
| Rural | Ref. | | | |
| Urban | 6.082 (0.675, 54.816) | 0.108 | | |
| **Education** | | | | |
| High school/technical school | Ref. | | | |
| Associate degree/bachelor's degree | 1.059 (0.294, 3.813) | 0.930 | | |
| Master's degree and above | 0.775 (0.205, 2.929) | 0.707 | | |
| **Occupation** | | | | |
| Full-time employee/part-time employee/freelancer | Ref. | | | |
| Others | 1.244 (0.601, 2.575) | 0.556 | | |
| **Monthly income per capita** | | | | |
| <10,000 | Ref. | | Ref. | |
| 10,000–20,000 | 2.877 (1.658, 4.994) | <0.001 | 1.503 (0.732, 3.086) | 0.267 |
| >20,000 | 1.207 (0.603, 2.418) | 0.595 | 0.968 (0.414, 2.265) | 0.941 |
| **Medical professional** | | | | |
| Yes | 0.406 (0.251, 0.658) | <0.001 | 0.380 (0.203, 0.712) | 0.003 |
| No | Ref. | | Ref. | |
| **Are you myopic** | | | | |
| Yes | 1.223 (0.734, 2.036) | 0.439 | | |
| No | Ref. | | | |
| **Used of orthokeratology lenses** | | | | |
| Yes | 0.411 (0.188, 0.898) | 0.026 | 0.782 (0.309, 1.982) | 0.605 |
| No | Ref. | | Ref. | |
| **Relation with the child** | | | | |
| Father | Ref. | | Ref. | |
| Mother | 2.492 (1.399, 4.440) | 0.002 | 1.565 (0.217, 11.301) | 0.657 |
| Others | 1.058 (0.366, 3.054) | 0.917 | 1.269 (0.206, 7.798) | 0.797 |
| **Child's age (years)** | 0.952 (0.894, 1.015) | 0.132 | | |
| **Child's degree of myopia** | | | | |
| Left eye | 1.000 (0.998, 1.001) | 0.574 | | |
| Right eye | 1.000 (0.998, 1.001) | 0.827 | | |
| **Duration of myopic (years)** | 0.927 (0.850, 1.012) | 0.090 | | |
| **Duration of wearing orthokeratology lenses (years)** | 1.010 (0.910, 1.120) | 0.856 | | |

(*Continued*)

**Table 5** (Continued).

| | Univariate Regression | | Multivariate Regression | |
|---|---|---|---|---|
| | **OR (95% CI)** | **P** | **OR (95% CI)** | **P** |
| **Spending on orthokeratology lenses annually** | | | | |
| <10,000 | Ref. | | Ref. | |
| 10,000–15,000 | 1.067 (0.679, 1.678) | 0.778 | 1.040 (0.612, 1.766) | 0.885 |
| 15,000–20,000 | 1.751 (1.036, 2.959) | 0.037 | 0.952 (0.512, 1.771) | 0.878 |
| >20,000 | 1.498 (0.556, 4.037) | 0.425 | 1.685 (0.538, 5.274) | 0.370 |
| **Duration of wearing the orthokeratology lenses each day** | | | | |
| <7h | Ref. | | Ref. | |
| 7–8h | 0.997 (0.585, 1.702) | 0.993 | 0.845 (0.457, 1.560) | 0.590 |
| 8–9h | 1.461 (0.856, 2.492) | 0.165 | 1.347 (0.722, 2.513) | 0.349 |
| 9–10h | 3.091 (1.602, 5.964) | <0.001 | 2.375 (1.127, 5.002) | 0.023 |
| > 10h | 1.299 (0.452, 3.736) | 0.628 | 0.987 (0.305, 3.194) | 0.982 |
| **Best visual acuity after wearing the lenses** | | | | |
| <1.0 | Ref. | | Ref. | |
| ≥1.0 | 0.624 (0.435, 0.895) | 0.010 | 0.897 (0.574, 1.403) | 0.634 |
| **Axial length stable after wearing the lenses** | | | | |
| Yes | 0.970 (0.471, 1.997) | 0.934 | | |
| No | Ref. | | | |
| **See clearly throughout the day after wearing the lenses** | | | | |
| Yes | 2.343 (1.031, 5.326) | 0.042 | 2.245 (0.815, 6.183) | 0.118 |
| No | Ref. | | Ref. | |
| **People for removing and caring for the lenses** | | | | |
| Father | 1.059 (0.422, 2.659) | 0.903 | 1.367 (0.459, 4.073) | 0.574 |
| Mother | 2.412 (1.561, 3.726) | <0.001 | 1.419 (0.792, 2.544) | 0.240 |
| The child | Ref. | | Ref. | |

**Table 6** SEM Model Fit

| Indicators | Reference | Actual |
|---|---|---|
| CMIN/DF | 1–3: Excellent, 3–5: Good | 2.038 |
| RMSEA | <0.08: Good | 0.046 |
| IFI | >0.8: Good | 0.826 |
| TLI | >0.8: Good | 0.802 |
| CFI | >0.8: Good | 0.822 |

**Table 7** SEM Results

| | | | β | P |
|---|---|---|---|---|
| Attitude | <- - - | Knowledge | 0.370 | 0.004 |
| Practice | <- - - | Attitude | 0.622 | <0.001 |
| Practice | <- - - | Knowledge | 1.623 | <0.001 |

to better access to resources and healthcare information.[21,22] In this study, parents with a medical background exhibited more positive attitude and proactive practice, likely due to their familiarity with eye health protocols and knowledge of the consequences of poor compliance.

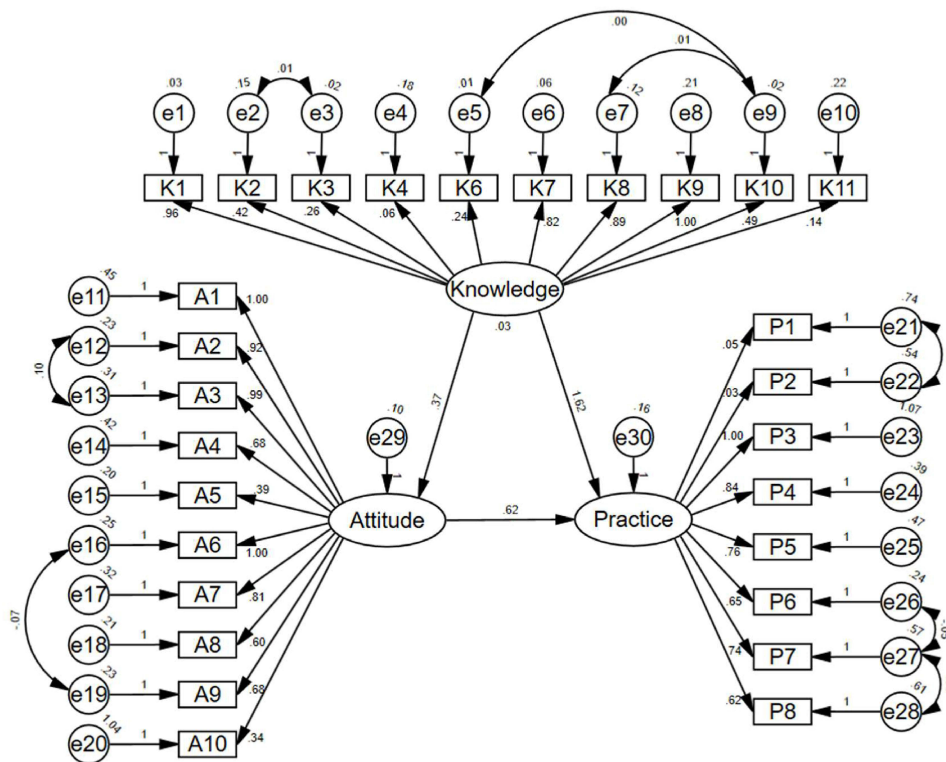


**Figure 1** SEM.

Notably, urban parents demonstrated higher KAP scores compared to rural counterparts, a pattern seen in other health behavior studies where urban populations often benefit from more accessible healthcare education and support systems.[23,24] In rural settings, limited access to educational resources and healthcare services may restrict parents' awareness of best practice for orthokeratology lens care.

Income level was another factor associated with practice scores, with middle-income parents (10,000–20,000 Yuan) demonstrating the most proactive practice. This trend could be related to greater affordability of orthokeratology services without the over-reliance on external caregivers often observed in higher-income groups, where delegation of child care responsibilities may detract from hands-on involvement in lens care.[25,26]

A deeper look at KAP dimensions reveals several specific areas where knowledge and practice could be improved. Knowledge gaps were particularly notable in understanding the risks and complications associated with orthokeratology. For instance, only around half of parents recognized corneal staining as a common complication, despite similar studies reporting that awareness of adverse effects is crucial for proactive care and early detection of complications.[27,28] Low awareness of corneal complications might contribute to delayed responses to symptoms or inadequate follow-up, ultimately affecting the efficacy and safety of orthokeratology treatment. This relatively modest level of risk awareness may help explain why the majority of parents reported neutral or low concern about potential risks in the attitude item A4. Additionally, demonstrating the correct procedure for lens handling and care, followed by printed guidelines or access to a digital manual, could reinforce safe practice at home.

The practice dimension further revealed that many parents do not consistently follow proper procedures for lens removal or care. This observation aligns with findings in other studies that identify lens handling errors as common, particularly among non-medical populations lacking formal healthcare training.[29] Considering that improper lens handling can lead to complications, this is an area warranting targeted intervention. Additionally, creating a series of short video tutorials covering essential lens care routines, accessible through QR codes on product packaging, could provide parents with a quick, convenient reference.

In terms of correlation between KAP dimensions, results from correlation and SEM analyses reinforce the hypothesis that knowledge positively influences both attitude and practice. This finding mirrors conclusions in other health behavior research, which suggests that improved knowledge often fosters more favorable attitude and subsequently more consistent, compliant behaviors.[12,30] For example, parents who understand the importance of routine follow-ups may be more likely to adhere to these appointments, knowing they are critical for monitoring their child's eye health and adjusting treatment if necessary.

Based on these findings, targeted and practical educational strategies are needed to improve KAP, particularly for parents with limited healthcare exposure or living in rural areas. Low-cost and accessible formats may help bridge knowledge gaps and support safer orthokeratology care practices, reinforcing the role of Ortho-K in myopia control.[31,32]

This study has several limitations. First, as a cross-sectional study, it only provides a snapshot of KAP at a single point in time, limiting the ability to infer causation or observe changes over time. Second, the study was conducted at a single ophthalmology department during a limited timeframe (November 8–30, 2024), which may restrict the generalizability of the findings to other settings or regions. Third, we did not assess parents' awareness of the clinical success rate of orthokeratology; therefore, the influence of perceived treatment success on their KAP could not be evaluated. Future research should include this variable to provide a more complete understanding of parental decision-making.

In addition, we did not directly assess parents' awareness of the clinical success rate of orthokeratology, so the influence of perceived treatment success on their KAP could not be evaluated in this study. Finally, all KAP data were obtained from self-administered questionnaires and therefore reflect parents' own perceptions and recollection of their knowledge and behaviors, which are central to the construct we aimed to evaluate. At the same time, parents may not accurately recall details of their children's lens-wear routines or previous complications, and they may overreport desirable practices such as adherence to cleaning protocols or follow-up visits. Consequently, recall bias and social desirability bias remain possible and may have led to some overestimation of knowledge, attitude, and practice scores. Additionally, as most participants were urban residents with relatively high educational and income levels, the findings may not be generalizable to populations with different socioeconomic backgrounds. Future studies should include more diverse samples, particularly from rural or socioeconomically disadvantaged groups, to better represent the full spectrum of parents using orthokeratology. Future multicenter studies with a longer data collection period and objective measures are needed to confirm these findings and reduce self-report bias. Although this study was conducted in China, the findings may have relevance for other countries facing rising childhood myopia rates, as parental awareness and engagement play a similar role in Ortho-K use across different settings. However, cultural and healthcare system differences should be considered when applying these results internationally.

## Conclusion

In summary, most parents displayed sufficient awareness and responsible engagement in orthokeratology care, though a subset lacked full understanding of possible complications or correct handling steps. The results emphasize that informed and attentive parental participation is key to ensuring both the safety and effectiveness of orthokeratology in children. This study demonstrates the applicability of the KAP framework in understanding how parents' knowledge and attitudes shape their actual care behaviors in myopia management. By using the KAP model, the study provides a structured approach to identify cognitive and behavioral gaps that can guide the development of targeted educational interventions. Enhancing parental education on orthokeratology through targeted, accessible training programs may foster better adherence to lens care guidelines, ultimately supporting safer and more effective myopia management in children. These findings may also help inform future public health initiatives and clinical practice guidelines that emphasize parental education as part of comprehensive myopia control programs. Notably, this study is among the few to apply SEM to explore the pathways linking knowledge, attitude, and practice in the context of pediatric orthokeratology, providing new evidence for targeted parental education strategies.

## Abbreviations

KAP, Knowledge, attitude, and practice; SEM, Structural equation modeling; SD, Standard deviation; ANOVA, Analysis of variance; RMSEA, Root mean square error of approximation; SRMR, Standardized root mean square residual.

## Data Sharing Statement

All data generated or analysed during this study are included in this published article.

## Ethics Approval and Consent to Participate

The study was carried out after the protocol was approved by the Ethic Committee in Beijing Huimin Hospital (20240027). I confirm that all methods were performed in accordance with the relevant guidelines. All procedures were performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments, and informed consent was obtained from all participants.

## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors declare that they have no competing interests for this work.

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