Current Eye Research, Early Online, 1–9, 2015

ISSN: 0271-3683 print / 1460-2202 online
DOI: 10.3109/02713683.2015.1050743

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ORIGINAL ARTICLE

Efficacy, Safety and Acceptability of Orthokeratology on Slowing Axial Elongation in Myopic Children by Meta-Analysis

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ABSTRACT

Purpose: To compare the efficacy, safety and acceptability of a treatment group (Orthokeratology) to a control group (single vision Spectacles) on slowing axial elongation in children.

Methods: We searched studies in MEDLINE, EMBASE and the Cochrane Library up to January 2015 for randomized controlled trials (RCTs) and observational studies. We pooled the mean differences between the Orthokeratology and Control groups for axial elongation and the OR for rates of adverse events and dropout.

Results: Three RCTs and six cohort studies with 667 children aged 6–16 years old were included. Two years' mean differences in axial elongation were −0.27 mm (95% confidence intervals [CI], −0.32 to −0.23) in all studies, −0.28 mm (95% CI, −0.35 to −0.20) in RCTs and −0.27 mm (95% CI, −0.32 to −0.22) in cohort studies ($p < 0.01$). At 6 months, 1 year, 1.5 years and 2 years, mean differences in axial elongation were −0.13 mm, −0.19 mm, −0.23 mm, and −0.27 mm ($p < 0.01$), respectively. The effect was greater in Asian children than Caucasian (−0.28 mm versus −0.22 mm) and in children with moderate to high myopia when compared to children with low myopia (−0.35 mm versus −0.25 mm). Orthokeratology had more non-significant adverse events (odd ratio [OR], 8.87; 95% CI, 3.79–20.74; $p < 0.01$) but comparable dropout rates (OR = 0.84, 95% CI, 0.40–1.74, $p = 0.64$) than control.

Conclusion: Orthokeratology has significantly greater efficacy in controlling axial elongation in children compared to Spectacle correction. The safety and acceptability results are good, and there appears to be a greater myopia control effect in Chinese children compared to Caucasians, and in those with higher initial myopia.

Keywords: Children, efficacy, myopia, orthokeratology, safety

Myopia has been a public health issue worldwide, especially in Asian areas.[1,2] There is an increasing prevalence of myopia in children,[2] with early on-set and high myopia becoming more prevalent over recent decades. Retinopathy caused by high myopia induced axial elongation has been ranked as the second most frequent cause of low-vision and blindness among adults in China.[3–6] Thus, strategies for controlling myopia progression in children, especially with respect to slowing axial elongation may be important for preventing future visual impairment and myopia-related pathology.[7]

Received 5 March 2015; revised 17 April 2015; accepted 5 May 2015; published online 3 August 2015

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Orthokeratology was first introduced in the early 1960s, but was shown to be ineffective. The development of reverse geometry lens designs that caused far greater refractive changes than previous Orthokeratology designs, high Dk materials and the use of corneal topography to optimize the lens fit and resolve complications lead to an increase in the clinical application of the procedure. Orthokeratology lenses alter the anterior corneal shape to cause central corneal flattening and mid-peripheral corneal steepening. FDA approval for the correction of myopia was granted in 2002.

Orthokeratology was first introduced in the early 1960's,[8] but was shown to be ineffective. The development of reverse geometry lens designs that caused far greater refractive changes than previous Orthokeratology designs, high Dk materials[9] and the use of corneal topography to optimize the lens fit and resolve complications lead to an increase in the clinical application of the procedure. Orthokeratology lenses alter the anterior corneal shape to cause central corneal flattening and mid-peripheral corneal steepening. FDA approval for the correction of myopia was granted in 2002.[10] Some recent randomized controlled trials (RCTs)[11–13] have reported that orthokeratology is effective in slowing axial elongation in myopic children with an estimated difference of 0.27–0.33 mm during 2 years compared with spectacles correction, and the effect is also comparable with atropine application.[14]

There were more well-conducted prospective observational studies that reported the effect of orthokeratology on slowing axial elongation in children.[15–20] However, it remains unclear as to whether the study design had an effect on the slowing of axial elongation. It is also unknown whether a rebound effect will occur after cessation of orthokeratology treatment, or whether orthokeratology has different effects in children with different myopic power. A meta-analysis will provide an opportunity to evaluate the difference between RCTs and observational studies, and may contribute new knowledge on the robustness of orthokeratology in diverse conditions.[21]

We have found that Asian children with low myopia benefit more (0.19D) from wearing multifocal spectacle lenses compared to Caucasian children (0.09D) with low myopia during 24 months,[22] and Asian children also benefit more (0.54D) from atropine compared to Caucasian children (0.35D).[23] It is unclear whether orthokeratology also has different effects on slowing axial elongation correspondent to ethnicity.

In this meta-analysis, we aimed to evaluate the efficacy, safety and acceptability of orthokeratology compared with control (single vision spectacle), based on RCTs and prospective observational studies, on slowing axial elongation in Asian and Caucasian children and to determine whether there was a difference in the outcomes of RCT and observational cohort studies, or differences in children with different levels of myopia and ethnicity.

METHODS

Data Sources and Searches

A systematic literature search with language restriction in English was conducted in MEDLINE, EMBASE and the Cochrane library for randomized controlled trials and observational studies on humans, up to 10 January 2015. The following Medical Subject Heading terms and keywords were used: myopia, refractive errors, clinical trial, randomized controlled trial, cohort study, orthokeratology, contact lens, reshape, corneal, controls, eyeglasses, placebo and children, as well as some relevant free terms. Boolean operator ''AND'', ''OR'', ''NOT'' were used to combine all search sets. References within those retrieved trials were used to search for additional studies. We also searched in Chinese Clinical Trial Registry, World Health Organization International Clinical Trials Registry Platform and ClinicalTrials.gov to retrieve those ongoing trials. We used a protocol for the present review which was used in our previous meta-analysis.[22,23]

Study Selection

RCTs and cohort studies on the relevant topic were selected according to the following criteria: (1) participants were school-aged children (6–17 years) with myopia (−0.25 to −10D); (2) orthokeratology was used in at least one treatment arm and single vision spectacles in another as control; (3) mean axial length elongation was studied as primary outcome, and secondary outcomes were the number of adverse events and the dropout rate from baseline to the end of the intervention period. (4) follow-up period >6 months.

Data Extraction and Quality Assessment

Two reviewers independently and jointly determined the eligibility of studies (SML and SSW) and extracted information from them (SML and MTK), including author, publication year, country or area, sample size, follow-up duration, intervention and control, mean change in axial elongation, rates of lost, number of adverse events and information on methodology. Any discrepancies were resolved by consensus between the two independent assessors or a third expert.

Quality of selected trials was determined according to Jadad scoring for RCTs[24] which includes: adequate method for randomization, appropriate blinding procedures, detailed report of withdrawals and dropouts. Newcastle–Ottawa Quality Assessment Scale (NOS) items were used to assess the quality of selected cohort studies which includes eight items within three domains: selection (representativeness), comparability (due to design or analysis), and outcomes (assessment and follow-up). A study can be awarded a maximum of one star for each numbered item within the Selection and Outcome categories. A maximum of two stars can be given for Comparability.[25]

Statistical Analysis

Data pooling was performed using Review Manager, Version 5.3 (Copenhagen: The Nordic Cochrane Centre, the Cochrane Collaboration, 2008). Differences in axial elongation between two groups were expressed as weighted mean differences (WMD; mean changes in the orthokeratology group minus that in the control group), together with 95% confidence intervals (CIs). To evaluate at what extent the myopia will be controlled in orthokeratology compared with control, myopia control rate is calculated using the following formula:

$$\text{Myopia control rate} = \frac{\text{mean axial length in control group} - \text{mean axial length in orthokeratology group}}{\text{mean axial length in control group}}$$

Acceptability was evaluated by the dropout rate of subjects who were lost to follow-up during the treatment. Odds ratio (OR) with 95% CI of proportions of adverse events was also calculated. Heterogeneity among studies was evaluated using χ^2 test and I^2 statistics.[26] A p value less than 0.1 was considered significant for the test of heterogeneity. A fixed-effect model was used to calculate estimates unless there was significant heterogeneity, in which case a random-effects mode was used. Subgroup analysis was performed based on study design (RCT versus cohort study), different follow-up periods and baseline myopia.

RESULTS

Study Characteristics

A total of 242 studies were found in initial search. After excluding 53 duplicate reports of the same studies, 155 unrelated studies and review articles, and

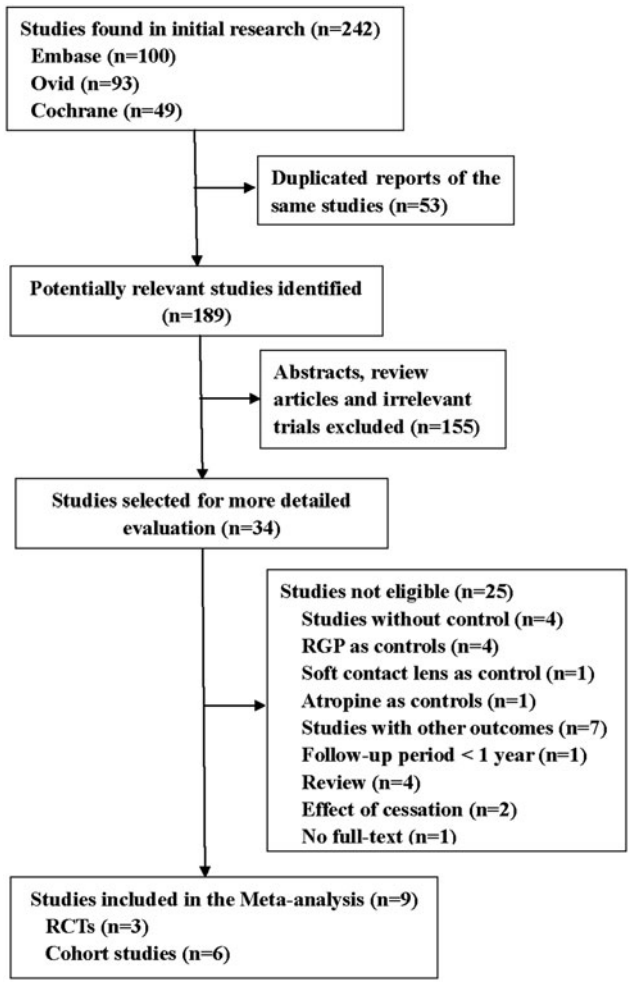

FIGURE 1 Flow chart of studies included, RCTs = randomized controlled trials.

25 studies that assessed other outcomes, other control, review or without control, 9 studies were finally included in this meta-analysis, of which 3 were RCTs[11–13] and 6 were cohort studies[15–20] (Figure 1). A total of 667 children aged from 6 to 16 years old were included for analysis, 511 children in the cohort studies and 156 in the RCTs. Of all children, 334 were treated with orthokeratology, 333 were treated with control (single vision spectacles). The children had a mean cycloplegic refraction ranging from −1.89 D to −8.25 D at baseline. All studies except for that by Hiraoka et al. (5 years) had a follow-up period of 2 years. The basic characteristics of included studies are listed in Table 1.

Quality Assessment

The quality of the RCTs was generally high (Table 2). The quality of the included cohort studies was high (Table 3). All of the 6 cohort studies met the criteria for representativeness of the exposed group and for selection of the control group, and were adjusted for

TABLE 1 Characteristics of the studies included in the meta-analysis.

Study (author, year)	Country or area	Design	Follow up (yrs)	Age (yrs)	Baseline refraction (D)		Lost/No. of subjects (dropout rate)	
					OK	Control	OK	Control
Cho et al. (2005)[15]	Hong Kong	Cohort study	2	7–12	−2.27 ± 1.09	−2.55 ± 0.98	8/43 (19%)	0/35 (0%)
Kakita et al. (2011)[14]	Japan	Cohort study	2	8–16	−2.55 ± 1.82	−2.59 ± 1.66	3/45 (7%)	10/60 (17%)
Hiraoka et al. (2012)[16]	Japan	Cohort study	5	8–12	−1.89 ± 0.82	−1.83 ± 1.06	7/29 (24%)	9/30 (30%)
Santodomingo et al. (2012)[19]	Spain	Cohort study	2	6–12	−2.20 ± 1.09	−2.35 ± 1.17	2/31 (6%)	6/30 (20%)
Chen et al. (2013)[18]	Hong Kong	Cohort study	2	6–12	−2.46 ± 1.32	−2.04 ± 1.09	8/43 (19%)	14/37 (38%)
Zhu et al. (2014)[17]	China	Cohort study	2	7–14	−4.29 ± 2.04	−4.24 ± 2.38	0/65 (0%)	0/63 (0%)
Cho et al. (2012)[11]	Hong Kong	RCT	2	6–10	−2.05 ± 0.72	−2.23 ± 0.84	14/51 (27%)	10/51 (20%)
Charm et al. (2013)[10]	Hong Kong	RCT	2	8–11	6.38 (5.75~8.25)	6.00 (5.50~8.00)	14/26 (54%)	10/26 (38%)
Chan et al. (2014)[12]	Hong Kong	RCT	2	8	−2.76 ± 0.45	−2.39 ± 0.59	0/1 (0%)	0/1 (0%)

OK, orthokeratology.

TABLE 2 Quality assessment of included randomized controlled trials in the meta-analysis.

Study	Randomization	Blinding	Lost to follow up	Allocation concealment	Analysis method	Jadad score
Charm et al. (2013)[10]	Adequate	SB	Adequate	Adequate	PP	4
Cho et al. (2012)[11]	Adequate	SB	Adequate	Adequate	PP	4
Chan et al. (2014)[12]	Unclear	NO	Adequate	NO	ITT	2

DB, double blinding; SB, single blinding; NO, no blinding or no allocation concealment; PP, per-protocol analysis; ITT, intention-to-treat analysis.

TABLE 3 Quality assessment of cohort studies included in the meta-analysis using Newcastle-Ottawa Quality Assessment Scale.

Study	Selection				Comparability of cohorts	Outcome			No. score
	Exposed cohort representative	Non-exposed cohort selection	Exposure ascertainment	Outcome not present at start		Assessment	Follow-up length	Follow-up adequacy	
Kakita et al. (2011)[14]	*	*	*	*	*	*	*	*	8
Hiraoka et al. (2012)[16]	*	*	*	*	*	*	*	*	8
Zhu et al. (2014)[17]	*	*	*	–	**	*	*	*	8
Cho et al. (2005)[15]	*	*	*	*	**	*	*	*	9
Chen et al. (2013)[18]	*	*	*	*	**	*	*	*	9
Santodomingo et al. (2012)[19]	*	*	*	*	**	*	*	*	9

*score. A study can be awarded a maximum of one asterisk for each numbered item within the Selection and Outcome categories. A maximum of two asterisks can be given for Comparability.

age, sex, initial spherical equivalent refraction and other important potential confounders. All studies had an independent outcome assessment or recorded linkage for the outcome. The follow-up of all studies was assessed adequately.

Efficacy

A fixed-effects model was used since there was no significant heterogeneity between all studies ($p = 0.68$, $I^2 = 0\%$). The mean difference in slowing axial elongation between orthokeratology and control was −0.27 mm (95%CI, −0.32 to −0.23; $p < 0.01$) (Figure 2, bottom) during 2 years. The myopia control rates were 33–89% (mean 66%) at 6 months, 41–80% (mean 60%) at 1 year, 21–67% (mean 48%) at 1.5 years and 24–63% (mean 43%) at 2 years (Table 4).

Results of RCTs

A fixed-effects model was used since there was no statistically significant heterogeneity between the RCTs ($p = 0.68$, $I^2 = 0\%$). The pooled mean difference in slowing axial elongation of orthokeratology and control was −0.28 mm during 2 years (95%CI, −0.35 to −0.20; $p < 0.01$) (Figure 2, upper).

Results of Cohort Studies

We used a fixed-effects model due to no significant heterogeneity ($p = 0.42$, $I^2 = 0\%$). The mean difference in the effects of orthokeratology in slowing axial elongation was −0.27 mm (95%CI, −0.32 to −0.22;

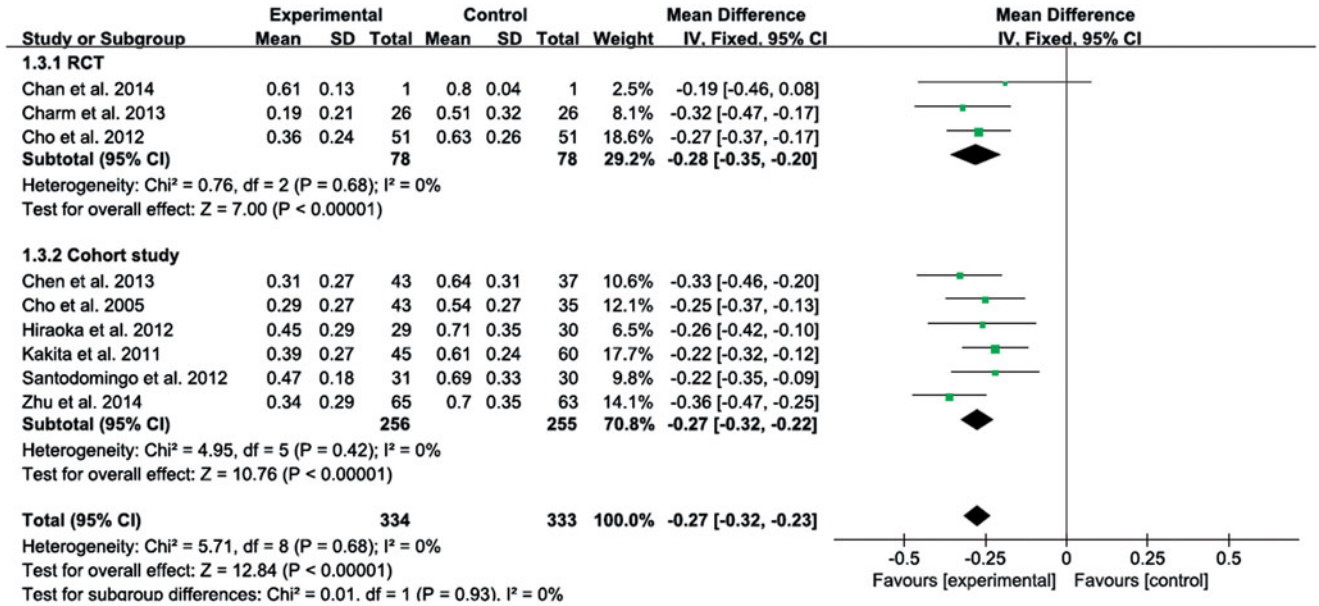

FIGURE 2 Forest graph of the effect of orthokeratology on slowing axial elongation during 2 years from RCTs ($n = 3$) and cohort studies ($n = 6$), respectively.

TABLE 4 Changes in axial length during different periods of follow-up from baseline.

Study (author, year)	Follow up (yrs)	Machine for measuring axial length	Baseline axial length (mm)		Change in axial length (mm)		Myopia control rate (%)
			OK	Control	OK	Control	
Cho et al. (2005)[15]	0.5	A-scan	24.50 ± 0.71	24.64 ± 0.58	0.03 ± 0.13	0.24 ± 0.13	88
—	1	—	—	—	0.16 ± 0.20	0.34 ± 0.16	53
—	1.5	—	—	—	0.19 ± 0.22	0.47 ± 0.19	60
—	2	—	—	—	0.29 ± 0.27	0.54 ± 0.27	46
Zhu et al. (2014)[17]	1	IOLMaster	24.91 ± 0.83	24.85 ± 1.08	0.16 ± 0.17	0.39 ± 0.21	59
—	2	—	—	—	0.34 ± 0.29	0.70 ± 0.35	51
Charm et al. (2013)[10]	0.5	IOLMaster	26.05 ± 0.80	25.97 ± 0.53	0.02 ± 0.10[&]	0.19 ± 0.11[&]	89
—	1	—	—	—	0.06 ± 0.12[&]	0.30 ± 0.19[&]	80
—	1.5	—	—	—	0.14 ± 0.13[&]	0.43 ± 0.25[&]	67
—	2	—	—	—	0.19 ± 0.21[&]	0.51 ± 0.32[&]	63
Kakita et al. (2011)[14]	2	IOLMaster	24.66 ± 1.11	24.79 ± 0.80	0.39 ± 0.27	0.61 ± 0.24	36
Hiraoka et al. (2012)[16]	1	—	—	—	0.19 ± 0.09	0.38 ± 0.20	50
—	2	—	—	—	0.45 ± 0.29*	0.71 ± 0.35*	37
—	3	—	—	—	0.64 ± 0.35*	1.00 ± 0.45*	36
—	4	—	—	—	0.82 ± 0.40*	1.24 ± 0.55*	34
—	5	IOLMaster	24.09 ± 0.77	24.22 ± 0.71	0.99 ± 0.47	1.41 ± 0.68	30
Chen et al. (2013)[18]	0.5	IOLMaster	24.37 ± 0.88	24.18 ± 1.00	0.07 ± 0.13	0.19 ± 0.08	63
—	1	—	—	—	0.15 ± 0.18	0.36 ± 0.16	58
—	1.5	—	—	—	0.24 ± 0.23	0.51 ± 0.24	53
—	2	—	—	—	0.31 ± 0.27	0.64 ± 0.31	52
Cho et al. (2012)[11]	0.5	IOLMaster	24.48 ± 0.71	24.40 ± 0.84	0.09 ± 0.10	0.20 ± 0.11	55
—	1	—	—	—	0.20 ± 0.15	0.37 ± 0.16	46
—	1.5	—	—	—	0.30 ± 0.20	0.50 ± 0.21	40
—	2	—	—	—	0.36 ± 0.24	0.63 ± 0.26	43
Santodomingo et al. (2012)[19]	0.5	IOLMaster	24.40 ± 0.81	24.22 ± 0.91	0.12 ± 0.11[&]	0.18 ± 0.10[&]	33
—	1	—	—	—	0.22 ± 0.09[&]	0.37 ± 0.18[&]	41
—	1.5	—	—	—	0.42 ± 0.13[&]	0.53 ± 0.31[&]	21
—	2	—	—	—	0.47 ± 0.18[&]	0.69 ± 0.33[&]	32
Chan et al. (2014)	2	IOLMaster	24.74 ± 0.13	24.71 ± 0.08	0.61 ± 0.13	0.80 ± 0.04	24

OK, orthokeratology. Myopia control rate is defined as the ratio of difference in axial elongation between two groups and axial elongation in the control group. &Derived from standard error in combination with GetData Graph Digitizer 2.24; *The greatest SD from other studies at the same follow-up period were used here.

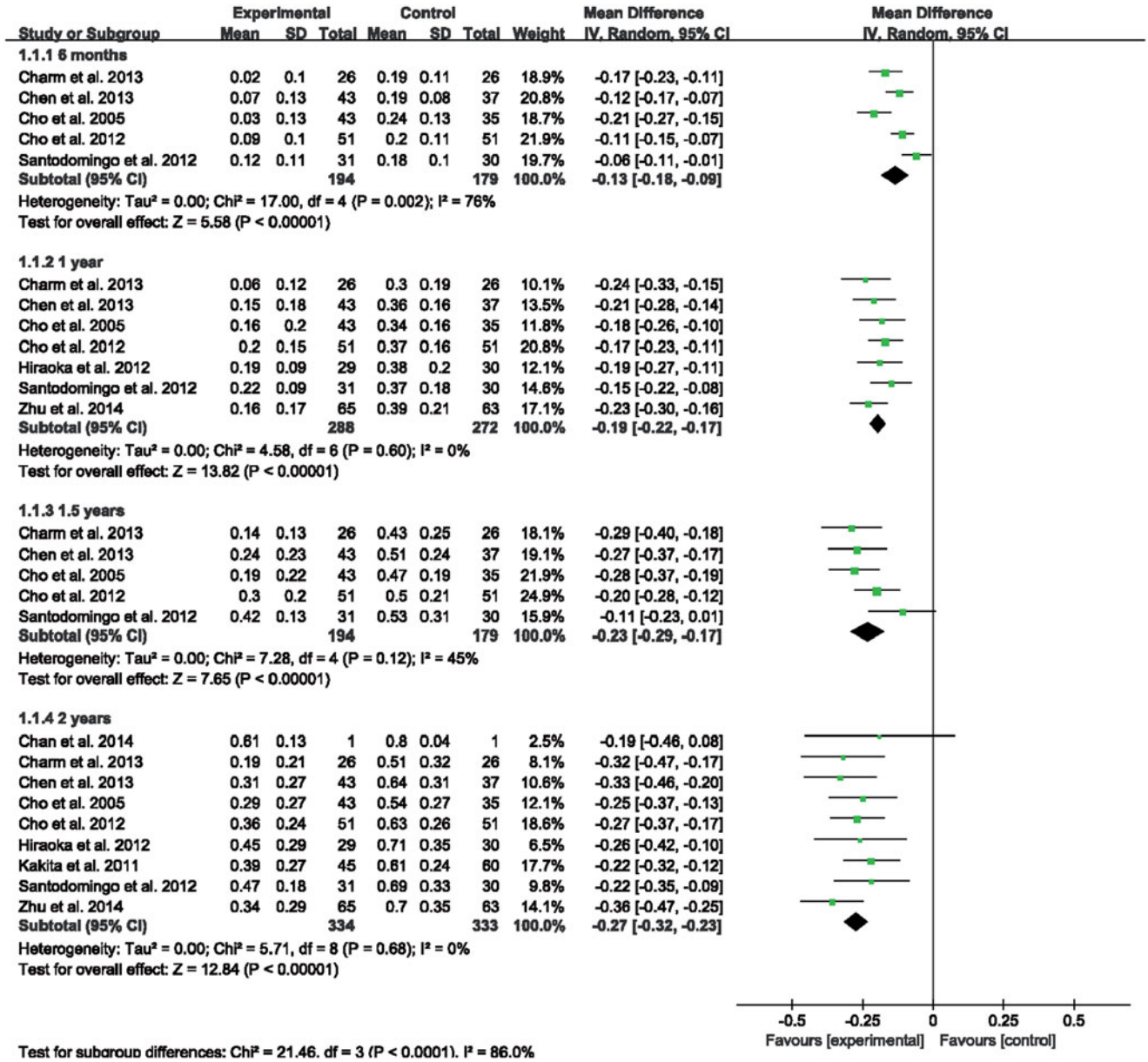

FIGURE 3 Forest graph of the effect of orthokeratology on slowing axial elongation during the treatment durations of 6 months ($n = 5$), 1year ($n = 7$), 1.5 years ($n = 5$) and 2 years ($n = 9$).

$p < 0.01$) compared with control during 2 years (Figure 2, center).

Results During Different Follow-Up Periods

The data of different follow-up periods showed no significant heterogeneity except for 6 months ($p = 0.01$, $I^2 = 69\%$, Figure 3). We used a random-effects model to achieve conservative results. There were significant difference in the effects of orthokeratology versus control in slowing axial elongation at all follow-up periods, with mean difference of −0.13 mm (95%CI, −0.17 to −0.09; $p < 0.01$) at 6 months, −0.19 mm (95%CI, −0.22 to −0.17; $p < 0.01$) at 1 year, −0.23 mm (95%CI, −0.29 to −0.17; $p < 0.01$) at 1.5 years, and −0.27 mm (95%CI, −0.32 to −0.23; $p < 0.01$) at 2 years, respectively.

Results of Different Ethnicity

One cohort study[20] was performed in Caucasian children with a difference of −0.22 mm (95%CI, −0.35 to −0.09), while other cohort studies in Asian children had an estimation of −0.28 mm (95%CI, −0.32 to −0.24; $p < 0.01$) (Not shown in Figure).

Results of Different Baseline Myopia

Two studies[11,18] reported the data of children with moderate to high myopia at baseline, with a pooled mean difference in axial elongation of −0.35 mm (95%CI, −0.43 to −0.26; $p < 0.01$). As for other studies with low myopia at baseline, the mean difference in axial elongation was −0.25 mm (95%CI, −0.30 to −0.21; $p < 0.01$) (Not shown in Figure).

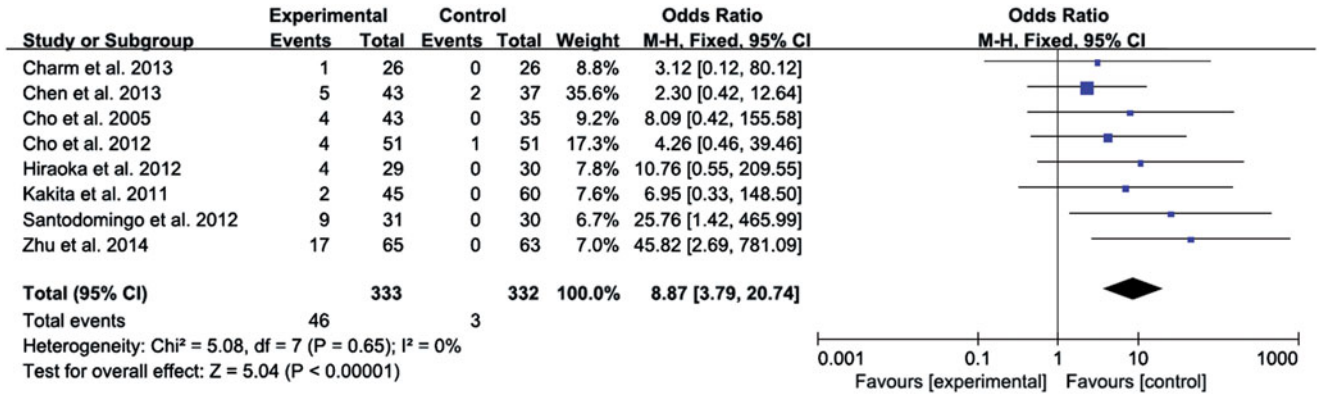

FIGURE 4 Forest graph of the adverse events for orthokeratology versus control during the treatment of myopia in children.

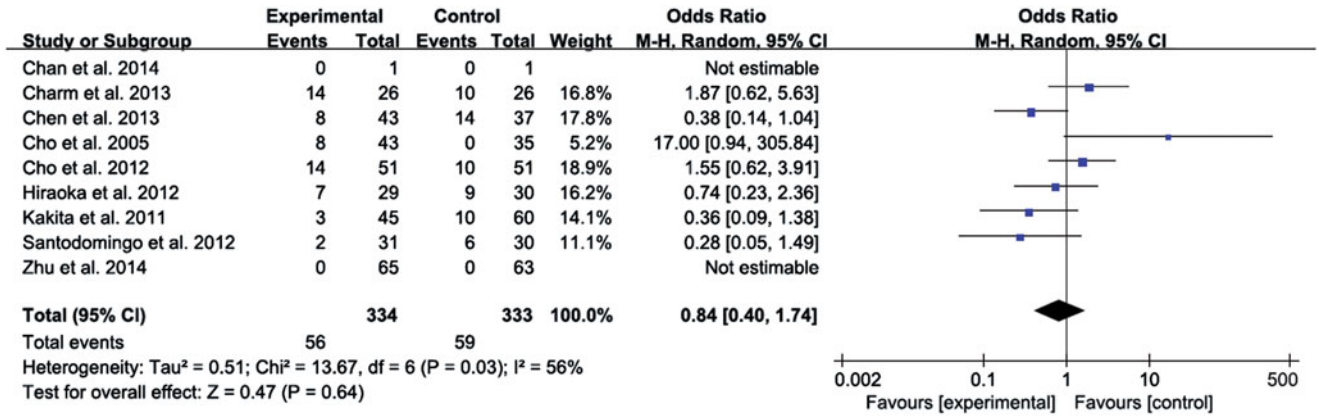

FIGURE 5 Forest graph of the dropout rate of all studies.

Safety

Figure 4 shows the proportion of adverse events between the two groups. Orthokeratology showed a significantly high proportion of adverse events compared with control (OR = 8.87, 95% CI, 3.79–20.74, $p < 0.01$). The proportions of adverse events were 3.8–29.0% in the orthokeratology group and 0–5.4% in the control group, with overall proportions of 13.8% and 7.4%, respectively. However, all adverse events were not significant and recovered quickly after treatment or discontinuation of wearing orthokeratology.

Charm et al.,[11] Chen et al.[19] and Zhu et al.[18] reported corneal staining; Cho et al.[16] reported 2 recurrent corneal staining and 2 inflammation; Cho et al.[12] reported 3 corneal staining and 1 conjunctival hyperemia in the orthokeratology group, 1 recurrent corneal inflammation in the control group; Hiraoka et al.[17] reported 3 moderate superficial punctuate keratopathy and 1 mild corneal erosion; Kakita et al.[15] reported 2 mild corneal erosion; Santodomingo et al.[20] reported 5 corneal erosions, 2 corneal staining and 2 papillary conjunctivitis.

Acceptability

The rates of lost were 0–54% in the orthokeratology group and 0–38% in the control group, respectively. There was no statistical significance for the dropout rate between the two groups (OR = 0.84, 95% CI, 0.40–1.74, $p = 0.64$; Figure 5).

DISCUSSION

This meta-analysis summarized the results from 3 RCTs and 6 well-conducted cohort studies on the efficacy, safety and acceptability of orthokeratology versus control on slowing axial elongation in children aged 6–16 years. The findings demonstrated that orthokeratology could significantly slow axial elongation with a difference of −0.27 mm during 2 years compared with control. When the treatment duration continued from 6 months to 2 years, the effect size increased from −0.13 mm with an increment rate of about 0.05 mm every half a year.

In agreement with our previous meta-analysis on atropine,[23] RCTs and cohort studies on

orthokeratology in this study also achieved similar effect size (−0.28 mm versus −0.27 mm) and thus were comparable. This finding is meaningful because it is relatively difficult to perform RCTs on orthokeratology at the current condition to confirm its effect on controlling myopia progression in children. Moreover, cohort studies are more feasible to observe the combined effects of multiple interventions such as atropine eyedrop, orthokeratology, traditional Chinese medicine including acupuncture, massage or exercises,[27] which may produce more promising effects.[5]

Interestingly, we found a greater effect of orthokeratology in Asian children than in Caucasian children with a difference of 0.06 mm in axial elongation during two years. This finding was consistent with those of our previous reports on atropine[23] and multifocal lenses.[22] Therefore, Asian children can benefit more from myopia interventions than Caucasian children, which may be due to initial higher myopia[28] and more rapid myopia progression[29] in Asian children than Caucasian children. In the present study, the difference in slowing myopia progression for orthokeratology versus control between Asian and Caucasian children was about 0.1 D/year. The ethnic difference was 0.19 D/year for atropine[23] and 0.05 D/year for multifocal lenses.[22]

Consistent with previous study,[22] the benefit from orthokeratology was greater in children with higher myopia at baseline than children with low myopia with a difference of 0.05 mm (about 0.15 D) during two years. It should be noted that the children with orthokeratology in the study by Charm et al.[11] still had to wear spectacles to correct residual refractive errors. These results indicated that orthokeratology, at least to some extent, could be recommended for children with high myopia to control myopia progression.

In the present study, orthokeratology was found to be about 9 times more likely to cause adverse events than control. However, all adverse events were nonsignificant and resolved quickly with no permanent corneal damage. Therefore, orthokeratology is a relatively safe option for controlling myopia progression in children. The rate of lost was also nonsignificant between the two groups which further indicated that orthokeratology was acceptable by the children and parents.

The proposed mechanism for myopia development has indicated that peripheral defocus and accommodation as the two main factors.[1] Orthokeratology is presumed to slow axial elongation by altering relative peripheral hyperopic defocus by steepening the mid-peripheral corneal curvature, whilst flattening the central cornea to correct myopic defocus.[30,31] Spherical aberration is another optical factor that may also play a role in the myopia control effect of orthokeratology.[32] However, a recent study by Hiraoka et al.[33] found that axial elongation was most related to come-like aberration, followed by defocus, but not to spherical aberration. Our previous study in the Anyang Childhood Eye Study also found that peripheral astigmatism might be a cause of ocular growth in children.[34] These findings indicate asymmetric components of optics may play an important role in slowing axial elongation. However, further evidence is required before any firm conclusion can be made on the mechanism of myopia control in orthokeratology.

There are some limitations in this meta-analysis. Firstly, only axial elongation was evaluated in our study due to scarcity of reports on myopia progression in refractive error. Slowing axial elongation is not the same thing as slowing or reducing myopia. There were also a few studies that reported the rebound effect of orthokeratology after it cessation, which should be evaluated in further study. Secondly, only studies in English were included in this meta-analysis, which may cause potential publication bias. Thirdly, most studies on orthokeratology were conducted in Asian children. Only one trial was conducted in Caucasian children in Spain.[20] More studies on Caucasian children are required in order to confirm the possible link between orthokeratology efficacy and ethnicity.

In summary, this meta-analysis found that orthokeratology could slow axial elongation in children with good efficacy, safety and acceptability compared with control, with similar effects achieved in RCTs and cohort studies. Asian children were more likely to benefit from wearing orthokeratology than Caucasian children. The questions needed to be further clarified are: what is the intrinsic mechanism involved in the control of myopia progression of children, and in the different effect between Asian and Caucasian children? How can the treatment effect last after cessation of orthokeratology? Is there a greater effect on myopia control with a combination of treatments?

DECLARATION OF INTEREST

This work was supported by the Major State Basic Research Development Program of China (''973'' Program, 2011CB504601), the Major International (Regional) Joint Research Project of the National Natural Science Foundation of China (81120108807), Beijing Nova Program (Z121107002512055), and the National Natural Science Foundation of China (81300797).

The authors have no conflicts of interest.

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