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Non-Surgical Management of Abnormal Head Posture in Duane Retraction Syndrome: A Mini Review

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ABSTRACT

Duane retraction syndrome (DRS) is a congenital ocular motility disorder characterized by dysinnervation of the lateral rectus muscle, limited horizontal movement, and globe retraction with palpebral fissure narrowing on adduction. Many affected children adopt abnormal head posture (AHP) to maintain binocular single vision and avoid diplopia. When such postures appear early in life and persist through the years of rapid craniofacial growth, they may predispose the patient to facial asymmetry and musculoskeletal imbalance. Surgical correction can improve alignment and reduce AHP in selected cases but is often deferred in very young children or when primary position deviation is small. This short communication summarizes the patterns of AHP in the main clinical types of DRS, reviews key elements of non-surgical management (including amblyopia therapy, refractive correction, simple positioning strategies, and use of the patch test), and highlights the importance of early recognition and intervention to reduce the risk of permanent craniofacial changes.

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Introduction

Duane retraction syndrome (DRS) is a congenital, restrictive form of strabismus and a prototype of the congenital cranial dysinnervation disorders [1]. It most commonly results from the absence or hypoplasia of the abducens nerve, with aberrant oculomotor innervation of the lateral rectus muscle, leading to co-contraction of the horizontal recti during adduction [2, 3]. Clinically, DRS is defined by variable limitation of abduction and/or adduction, with globe retraction and narrowing of the palpebral fissure during attempted adduction, sometimes accompanied by upshoot or downshoot [4-6]. DRS accounts for approximately 1–5% of all strabismus, and Huber type I is the most common form [3, 4, 7].

Classically, three main clinical types are recognized: type I with marked limitation of abduction and relatively preserved adduction; type II with limitation of adduction and relatively preserved abduction; and type III with limitation of both adduction and abduction [1, 5, 8]. Kekunnaya et al. emphasized that abnormal head posture, a smaller appearing eye due to globe retraction, and unusual eye movements are among the most frequent reasons for referral in children with DRS [4].

AHPs have been extensively reviewed and are recognized as adaptive mechanisms to optimize vision, maintain binocularity, or increase centration of a limited visual field [9, 10]. Common ocular causes include nystagmus, superior oblique palsy, and DRS; DRS is consistently listed as a classic etiology of ocular torticollis in childhood [9, 11, 12].

This review aimed to highlight non-surgical approaches to AHP in DRS, with particular emphasis on early clinical recognition and prevention of secondary craniofacial changes. This aspect has received limited attention in the existing literature.

Materials and Methods

This review was conducted using a narrative, non-systematic approach to summarize the current knowledge regarding AHP in DRS and its non-surgical management. Peer-reviewed articles, clinical reviews, and major reference texts in pediatric ophthalmology and strabismus were examined. Searches were performed in PubMed, Google Scholar, and Scopus using terms related to “duane retraction syndrome,” “abnormal head posture,” “ocular torticollis,” “facial asymmetry,” and “non-surgical management.” Studies describing clinical characteristics, mechanisms of AHP, craniofacial consequences, and management strategies were included. No date restriction was applied. The objective of this methodology was to provide an updated synthesis of relevant findings; no statistical pooling or quality grading of evidence was performed, consistent with the goals of a narrative review.

Discussion

Patterns of AHP in DRS

The direction of AHP in DRS reflects the pattern of ocular motility limitation and the field of gaze in which ocular alignment and fusion are most favorable. In unilateral type I DRS, characterized by marked limitation of abduction with relatively preserved adduction, patients typically adopt a face turn toward the affected eye. This ipsilateral face turn moves fixation into the adducted field of the involved eye, where the deviation is smaller and binocular single vision is more easily maintained. Nevertheless, individual patterns may vary depending on the balance among co-contraction, deviation from the primary position, suppression, and the extent of the field over which single binocular vision is possible [3, 4, 13, 14].

In type II DRS, where adduction is limited and abduction is relatively preserved, a contralateral face turn is more commonly observed because this positions fixation in the abducted field of the affected eye. In type III DRS, with limitations in both adduction and abduction, the compensatory head posture is more variable and usually represents a compromise position that minimizes the manifest deviation and associated symptoms, such as diplopia or asthenopia [9, 15, 16].

Because DRS is congenital, compensatory head postures often emerge early in life and may persist throughout childhood. Large clinical series of ocular AHP have shown that strabismus, including DRS, is among the leading causes of ocular torticollis in pediatric populations [15, 17]. When an abnormal posture is marked and long-standing, it may influence the developing craniofacial skeleton and cervical musculature over time, potentially resulting in persistent facial asymmetry and musculoskeletal changes [15, 17].

Craniofacial consequences of persistent

The relationship between long-standing ocular torticollis and facial asymmetry has been recognized for many years. Greenberg and colleagues introduced the term 'ocular plagiocephaly' to describe loss of facial volume and relative flattening on the side of habitual head turn or tilt in children with chronic ocular torticollis [18]. Subsequent clinical and imaging studies have confirmed that early-onset, persistent AHP—particularly in the context of congenital strabismus and superior oblique palsy—is associated with asymmetry of the orbital rims, midface, nasal framework, and overlying soft tissues [15, 19, 20].

More recent work on head posture and facial morphology has shown that both head tilt and pure head turn can be associated with measurable craniofacial asymmetry. DRS is frequently reported as an underlying diagnosis, with typical clinical examples demonstrating cheek flattening and narrowing of the ipsilateral nostril on the side of the head turn [15, 21, 22]. In DRS, similar biomechanical mechanisms are likely involved: continuous head rotation can modify the vectors of facial growth, producing recurrent compressive forces on one side and relative underuse of the contralateral musculature [9, 15, 21]. Clinically, some children with a long-standing unilateral head turn exhibit deviation of the nasal septum toward the side opposite the turn, asymmetry of the nasal apertures, and subtle soft-tissue volume loss on the compressed cheek—findings consistent with the broader literature on ocular plagiocephaly and positional craniofacial change [15, 18]. These alterations may persist even after ocular alignment has been improved, underscoring the importance of early recognition and timely management of AHP [15, 21].

Evaluation of AHP: Role of the patch test

Before planning treatment, it is essential to determine whether an AHP is primarily driven by the need to preserve binocularity or persists despite functional disruption [9, 23]. The monocular patch test is a simple, widely used clinical maneuver for assessing ocular torticollis: The habitually fixing eye is occluded, and any change in head position is carefully observed [9].

If the head posture improves or normalizes with monocular occlusion, the AHP is most likely a compensatory strategy to maintain single binocular vision. Conversely, if the posture remains unchanged, non-ocular factors—such as structural abnormalities, long-standing secondary neck adaptations, or a strong habitual component—are more likely to predominate. In such cases, the patch test may be 'negative' despite a clearly persistent AHP [23, 24].

The outcome of the patch test provides practical guidance for clinicians when counseling families about the likely impact of non-surgical interventions, the expected degree of improvement after ocular alignment surgery, and the potential need for orthopedic or physiotherapy referral when secondary neck changes have already developed [9, 24].

Non-surgical management strategies in DRS-related AHP

Although surgery remains the main option for correcting large primary-position deviations and marked AHP in DRS, non-surgical measures play an important complementary role. They are particularly relevant in younger children in whom surgery is deferred, and in milder cases where the primary-position deviation is small [4, 25]. Key components include the following.

Amblyopia treatment and refractive correction

A considerable proportion of children with DRS have clinically significant hyperopia, astigmatism, or anisometropia, and amblyopia has been reported in a notable minority of cases [26-28]. Therefore, cycloplegic refraction and full optical correction are essential [27]. Standard amblyopia therapy—most commonly occlusion of the better-seeing eye—has been successfully used in cohorts of patients with DRS [26, 27]. By improving fixation stability and visual acuity in the affected eye, amblyopia treatment may reduce the child's dependence on an extreme compensatory head posture to maintain comfortable vision, even though it does not alter the underlying dysinnervation or mechanical restriction [9, 27].

Counseling on head posture and sleep positioning

Families should be counseled regarding the adaptive nature of the child's head posture and the potential long-term effects on cervical alignment and facial growth [9, 11]. Based on principles drawn from the broader literature on ocular torticollis and positional plagiocephaly, clinicians may advise parents to avoid reinforcing fixed head positions during sleep and rest. In practice, this can include gently positioning the child with the head rotated in the opposite direction of the habitual daytime turn, or alternating sides, while maintaining a safe sleep environment. Although controlled trials specifically for

DRS are lacking, these positioning strategies are biologically plausible, low-risk, and consistent with general approaches used to limit positional craniofacial asymmetry in infancy [11]. Any suggested positioning should remain consistent with established safe sleep recommendations for infants, and parents should be counseled accordingly.

Observation, education, and timing of surgery

Recent clinical reports highlight that not all children with DRS and mild AHP require early surgical intervention, particularly when primary-position alignment is acceptable and visual acuity is good in both eyes [4, 25]. In such cases, careful observation with regular assessment of ocular alignment, head posture, and visual function—together with reinforcement of refractive correction and amblyopia therapy—may be sufficient in the short- to medium-term [25]. Surgery can be reconsidered if the head turn becomes more pronounced, if the primary-position deviation increases, or if the child develops symptoms such as neck pain, functional limitations in daily activities, or psychosocial distress related to appearance [9, 25]. This staged approach allows individualized timing of surgery while minimizing unnecessary operative interventions in children who are visually well compensated.

It should be acknowledged that much of the available literature on non-surgical management of AHP in DRS is derived from observational studies and narrative reviews. As a result, high-quality prospective and quantitative evidence remains limited. This highlights the need for future research to better define the effectiveness and long-term outcomes of non-surgical approaches.

Conclusion

AHP is a frequent and clinically meaningful manifestation of DRS. Because it typically emerges in early childhood and may persist throughout critical phases of craniofacial growth, affected children are at risk of developing long-term facial asymmetry and musculoskeletal imbalance. Evidence from studies on ocular torticollis, ocular AHP, and DRS suggests that timely recognition, accurate refractive correction, active amblyopia management, and explicit counseling about head posture are essential elements of care, even when definitive surgical intervention is postponed.

Non-surgical measures cannot substitute for surgery in patients with large primary position deviations or marked AHP; however, they provide an important means of supporting visual function and mitigating secondary consequences during the years when the child is still growing, and surgical planning is being individualized. For clinicians, a structured strategy that includes detailed documentation of AHP, application of the patch test, rigorous refractive and amblyopia management, and practical guidance regarding everyday head positioning may help reduce the likelihood of permanent facial asymmetry and musculoskeletal changes in this vulnerable group of patients.

Ethical Considerations

Compliance with ethical guidelines

This article is a narrative review with no human or animal sample.

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