

Revolutionising Keratoconus Management: Could Vitamin D Supplementation Play a Key Role in Stabilisation?

Sir,

Keratoconus is one of the most common asymmetric, bilateral corneal disorders, characterised by progressive thinning and cone-like steepening of the cornea. These alterations result in irregular astigmatism and, ultimately, significant vision impairment. It is an intricate disorder that typically affects adolescents and young adults, often requiring intervention as it progresses.¹

According to recent data, the global incidence of keratoconus is approximately 1.38 per 1,000 individuals. Saudi Arabia has one of the highest global prevalence rates, with 4,790 cases per 100,000 individuals.² A study conducted in Karachi reported that 8.04% of patients attending the cornea clinic were diagnosed with keratoconus.³

Management of keratoconus varies with disease severity, ranging from non-invasive conservative measures to invasive surgical interventions. In the early stages, visual rehabilitation is typically achieved with spectacles and rigid scleral contact lenses. Corneal collagen cross-linking (CXL) remains the mainstay to halt disease progression, ideally in early or progressive cases, with success rates of up to 90%. Intracorneal ring segments (ICRS) can help reshape the cornea in moderate disease, while advanced stages may require corneal transplantation, such as deep anterior lamellar keratoplasty (DALK) or penetrating keratoplasty (PKP). Recent advances have introduced emerging options, such as Bowman's layer transplantation, stromal regeneration, topography-guided treatments, artificial intelligence-based early detection tools, and investigational therapies, such as Vitamin D supplementation.⁴

A 2025 prospective study by Bartolomeo *et al.* explored the effects of Vitamin D supplementation in adolescents with keratoconus and found that 65% of patients showed disease stabilisation over 12 months, defined by less than a 1-dioptre change in maximal keratometry (Kmax). Patients with Vitamin D insufficiency (<30 ng/mL) received oral cholecalciferol supplementation at a dose of 50,000 IU once weekly for the first three months, followed by a maintenance regimen of 50,000 IU once monthly up to month six, with follow-up extending to 12 months. Alongside stable visual acuity and corneal thickness, the study reported favourable biochemical changes, including reduced matrix metalloproteinase (MMP)-9 and increased tissue inhibitor of metalloproteinases (TIMP)-1 levels, reflecting modulation of local and systemic inflammation. This is particularly significant given prior evidence linking Vitamin D deficiency with heightened MMP activity and corneal stromal degradation. Importantly, the investigators also incorporated baseline and interval laboratory monitoring of

serum Vitamin D and calcium, in addition to assessing visual acuity, corneal thickness, and molecular markers, thereby underscoring the importance of a multimodal approach to both efficacy and safety evaluation. Thus, while Kmax progression remains a widely accepted primary endpoint, the inclusion of additional parameters provides a more holistic assessment of treatment response, as demonstrated in this study.⁵

Despite the promising outcomes, several questions remain unanswered. The study was limited by its small sample size, relatively short duration, and focus on adolescents with early-stage keratoconus. While the regimen of 50,000 IU weekly followed by monthly appeared safe under monitored conditions, the optimal dosing strategy, duration of therapy, long-term safety, and efficacy in adults or patients with advanced keratoconus remain to be established. In particular, prolonged supplementation carries the risk of hypervitaminosis D, predisposing patients to hypercalcaemia, nephrocalcinosis, renal impairment, vascular calcification, and other systemic complications. Moreover, individual variability in response, potentially influenced by genetic or metabolic factors, has yet to be investigated. Future research should therefore include large-scale, multicentre randomised controlled trials with extended follow-up, exploration of potential synergy with established treatments such as CXL, and identification of molecular biomarkers predictive of response.

Nevertheless, the prospect of a safe, low-cost, and globally accessible intervention, such as Vitamin D supplementation, influencing the trajectory of a progressive corneal disease, may represent a paradigm shift in the management of keratoconus. It further underscores the importance of integrating systemic health assessment into the management of ocular conditions and opens new avenues for holistic, preventive, and widely accessible ophthalmic care.

COMPETING INTEREST:

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

ZJ: Conceived the study, designed the manuscript, and provided key clinical perspectives.

NN: Critically revised the manuscript for intellectual and factual accuracy.

SM: Conducted literature review, drafted the initial manuscript, participated in editing, and approved the final draft.

All authors approved the final version of the manuscript to be published.

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Received: June 02, 2025; Revised: August 20, 2025;
Accepted: August 21, 2025
DOI: <https://doi.org/10.29271/jcsp.2026.03.427>

