

Navigating goniotomy options: when to go for 360° and when a partial approach suffices

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In recent years, minimally invasive glaucoma surgeries (MIGS) have become a cornerstone in managing glaucoma, offering targeted treatments that facilitate trabecular outflow with minimal tissue disruption. Among the various MIGS, goniotomy (whether a conservative 90° to 180° or an extensive 360° approach) has garnered attention as a viable option for patients with varying degrees of disease severity. However, it is essential to assess whether every patient truly benefits from a complete 360° trabecular excision or if a partial approach is sufficient. Apart from determining the extent of goniotomy necessary to achieve the best efficacy–safety relationship, the trabecular meshwork (TM) has two important primary functions in the human eye: aqueous humor regulation and self-cleaning biological filter. It may also act as a barrier to blood reflux from the Schlemm's canal into the eye^(1,2). Therefore, even a partially impaired TM may have critical implications in a glaucomatous eye.

In the early 1980s, basic science studies have demonstrated that the relationship between the extent of TM excision and reduction in intraocular pressure (IOP) is not linear⁽³⁾. A closer look at the comparative data suggests that the difference in IOP reduction between the 90°, 180°, and 360° goniotomies may not be as significant as previously assumed. Clinical studies, such as

those by Hirabayashi et al.⁽⁴⁾ and Wecker et al.⁽⁵⁾, indicate that partial approaches, including sectoral goniotomy using a Kahook Dual Blade (KDB), can achieve IOP reduction that is comparable to the reduction achieved with a full 360° intervention. Similarly, in a recent multicenter study that included >200 patients with primary open-angle glaucoma, Zhang et al. found similar efficacy outcomes between 120°, 240°, and 360° goniotomies⁽⁶⁾. In their study, surgical success was defined as a postoperative IOP of 6 to 18 mm Hg and a 20% reduction in baseline IOP without the need for additional glaucoma surgery. Although the 120°, 240°, and 360° goniotomies exhibited a similar efficacy in IOP reduction and medication use, the 360° goniotomy was more likely to cause hyphema than the other goniotomies. This may be attributed to the greater extent of trabecular manipulation⁽⁶⁾ in the 360° goniotomy. By opting for a partial approach, surgeons may reduce the risk of this complication, thereby improving postoperative recovery and minimizing patient discomfort.

The long-term clinical impact of a complete 360° trabecular excision remains unclear. Although procedures such as gonioscopy-assisted transluminal trabeculotomy (GATT) have demonstrated more favorable outcomes in terms of IOP control in some patients (compared to procedures with lesser TM removal), the specific long-term effect of such an extensive excision on the disease stability is yet to be evaluated. Without data demonstrating an association between 360° excision and improved long-term structural and functional outcomes, a more conservative approach may be just as advantageous for maintaining stability in patients with mild-to-mo-

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derate glaucoma. In fact, favorable two-year outcomes, following a 180° GATT (hemi-GATT), have been reported even in patients with moderate-to-severe primary open-angle glaucoma⁽⁷⁾. For many patients, this indicates that achieving effective IOP control does not necessarily require a more extensive procedure, especially when the difference in outcomes may be modest at most.

Another factor to consider is the potential risk associated with a complete TM excision using GATT and other 360° techniques. The impact of surgical fibrosis in cases of procedure failure is not well understood. However, full trabecular impairment could pose challenges for future IOP management if fibrosis ensues⁽⁸⁾. In contrast, partial goniotomies leave some TM intact, which could mitigate these risks and preserve the ability to perform additional treatments if required. This rationale becomes particularly relevant in patients with early stage disease and younger patients, in whom maximizing long-term outflow options is a priority. On the other hand, if only partial fibrosis occurs in the site of TM excision, the procedure's efficacy is more likely to be preserved in complete goniotomies than in partial goniotomies, because a greater extent of the modified patent aqueous humor outflow system would be available. Another uncertainty with regard to fibrosis is related to the goniotomy technique, because the TM may be completely removed (e.g., KDB) or torn (e.g., GATT). It can be hypothesized that tearing would produce a more rapid and intense fibrosis than TM removal, because both edges of the torn TM would remain closely disconnected.

Ultimately, selecting the appropriate goniotomy approach hinges on careful patient assessment and a tailored treatment approach. Although a complete 360° excision may be suitable in certain patients, many can benefit from a less invasive partial goniotomy that balances effective IOP control with a lower risk of damage to the trabecular structure integrity. Furthermore, although

there is a lack of robust data to establish definitive guidelines, the authors suggest that partial goniotomy techniques may be appropriate for patients with mild-to-moderate glaucoma. A more extensive approach should be reserved for patients with a higher baseline IOP or those who require multiple medications, especially when a lower target IOP is needed. Moreover, the true impact of each procedure on the disease prognosis has yet to be determined. By choosing a personalized approach, clinicians can optimize patient outcomes and maintain flexibility for potential future interventions.

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