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The Netherlands

Laser tonsil treatment under local anesthesia: a patient-friendly effective alternative?

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Citation

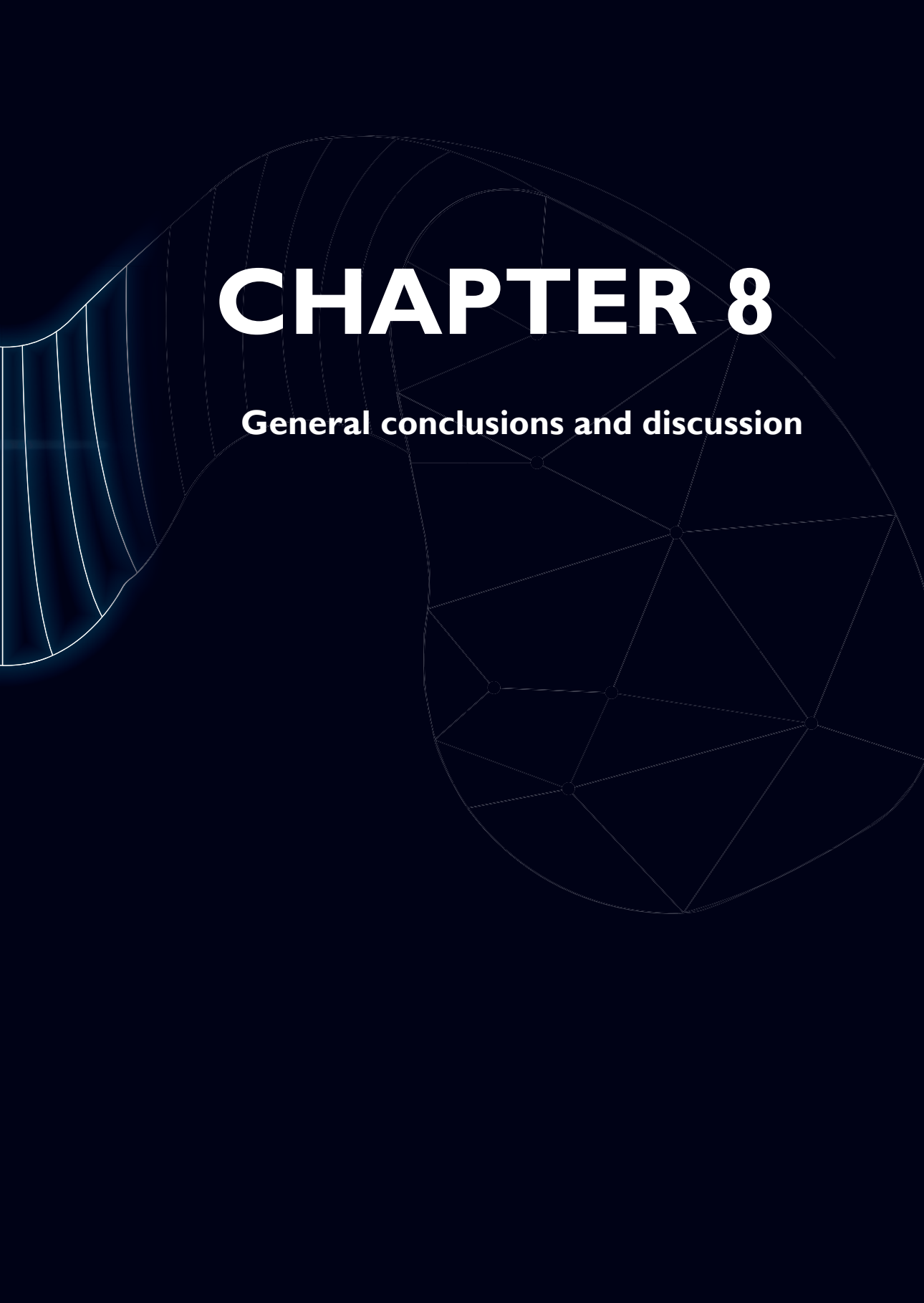
Wong Chung, J. E. R. E. (2025, November 6). *Laser tonsil treatment under local anesthesia: a patient-friendly effective alternative?*. Retrieved from <https://hdl.handle.net/1887/4282135>

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CHAPTER 8

General conclusions and discussion

This thesis explored whether tonsillotomy (TO) could serve as a safe, effective, and cost-efficient alternative to tonsillectomy (TE) for adults with tonsil-related conditions. The following discussion and conclusions evaluate the findings, comparing TO to TE in terms of surgical outcomes, recovery, and complication rates, while considering its potential for routine clinical application. These insights aim to contribute to advancements in understanding, clinical usability, and the development of less invasive, patient-friendly surgical options, as well as their broader availability for managing tonsil-related disorders.

KEY DIFFERENCES IN SURGICAL OUTCOMES RELATED TO CURRENT LITERATURE

In **Chapter 2** we present a systematic review of literature comparing TE and TO in adults with tonsil related afflictions. Based on current literature, TO appears to offer significant advantages including less post-operative pain, shorter recovery times and fewer complications. Eight out of nine studies found TO as effective as TE in tonsil-related symptoms resolution. For example, studies by Bender et al. and Lourijssen et al. (**Chapter 3**) reported lower pain scores and a reduced use of analgesics after TO, suggesting a less burdensome recovery process.^{1,2}

While TO shows promising results, concerns remain regarding residual tonsil tissue and potential recurrent symptoms, though these concerns are not substantiated by current evidence. Additionally, the lack of large, high-quality randomized trials and variations in surgical techniques limit definitive conclusions.

These findings indicate that TO could be a first-line treatment for many adults due to its lower morbidity. However, the review concludes that research gaps remain, particularly regarding long-term outcomes, the risk of tonsillar regrowth, and post-operative complications. To address these issues, we conducted the TOMTOM-study, from which the results are presented in **Chapters 6 and 7**.

THE MOST COMMON COMPLICATIONS ASSOCIATED WITH TONSILLOTOMY AND TONSILLECTOMY IN ADULT PATIENTS, BASED ON CURRENT LITERATURE.

In **Chapter 2**, the review highlights common complications of TE and TO, focusing on post-operative hemorrhage, pain, infection, and incomplete symptom resolution or

recurrence. TE is associated with a higher incidence of post-operative hemorrhage, with studies like Bender et al. reporting a 30% hemorrhage rate in TE patients compared to 12% in TO patients, with TE-related bleeding often more severe and recurrent.

Post-operative pain is consistently higher in TE patients, who also require more analgesic medication and experience slower recovery compared to TO patients. Infections, although rare, appear slightly more after TE, suggesting another potential advantage of TO.

Lastly, complications related to incomplete symptom resolution or recurrence, particularly with tonsillotomy, are important to address. Since tonsillotomy preserves some tonsillar tissue, there is a theoretical risk of recurrent or persistent tonsil issues.

However, the review of current literature did not demonstrate a significantly higher rate of persistent tonsil-related complaints after TO, but long-term outcomes of TO were insufficiently studied, which prompted us to further investigate this aspect in our study, as detailed in **Chapters 6 and 7**.

CO₂-LASER TONSILLOTOMY AS A VIABLE ALTERNATIVE TO TRADITIONAL TONSILLECTOMY IN ADULTS: POSTOPERATIVE OUTCOMES, RECOVERY TIME, AND COMPLICATION RATES

Recognizing the need for more evidence on the potential of CO₂-laser TO as an alternative to traditional TE in adults, we first conducted a prospective follow-up non-randomized cohort study, which is presented in **Chapter 3**. This study looked at the efficacy and post-operative outcomes of CO₂-laser TO compared to TE.

The findings of this study provide strong evidence that CO₂-laser TO can serve as a viable alternative to TE for adults, particularly with respect to post-operative recovery.

CO₂-laser TO significantly reduced post-operative pain with mean pain score on a Visual Analogue Scale (0-10) of 5.4 after TO compared to 7.7 in the TE group, and required fewer days for full recovery (4.8 days vs. 10.6 days for TE). TO patients return to daily activities faster, which is another important consideration for patients and clinicians.

However, the lower success rate of symptom resolution (72.5%) compared to TE (97.2%) suggests that CO₂-laser TO might not be universally effective for all patients. The need for re-surgery in a small percentage of cases (7.5%) underscores the importance of

careful patient selection to minimize the risk of recurrence. This indicates that while the procedure offers benefits in terms of recovery, its effectiveness might be limited in certain cases, potentially impacting long-term outcomes.

Compared to the broader literature, the findings presented in **Chapter 3** are consistent with previous reports that suggest a faster recovery with tonsillotomy techniques, though the issue of symptom recurrence has been less consistently reported. This suggests a gap in literature, underlining the need for larger randomized controlled trials with extended follow-up to validate the long-term efficacy of CO₂-laser TO.

These findings laid the groundwork for the systematic review presented in **Chapter 2**, which further explored the current literature and underscored the need for more robust, randomized studies with longer follow-up to fully establish the value of CO₂-laser TO as an alternative to TE.

CRITICAL STEPS IN PERFORMING A SAFE AND EFFECTIVE TONSIL- LOTOMY

In **Chapter 4**, we systematically describe a step-by-step protocol for performing CO₂-laser TO under local anesthesia in adults. A detailed guide is not only essential for standardized and safe outcomes but also fills a gap in the current literature by providing a structured and replicable approach. The inclusion of an online video instruction enhances the educational value, making it a valuable tool for both clinical training and patient safety.

The protocol focuses on patient selection, including assessing the gag reflex with the Gagging Severity Index (GSI), and pre-operative preparations. This helps ensure that patients are suitable candidates for the procedure and minimize intraoperative complications. The anesthesia protocol and laser treatment steps are outlined and emphasis the preservation of the tonsil capsule, which is a significant difference from the more invasive TE.

The importance of this detailed procedural description goes beyond individual clinical practice. The protocol serves as a valuable educational tool for training new surgeons and the video format allows learners to visualize the technique, grasp the importance of each step, and understand the subtleties that can only be conveyed through demonstration. This is especially important for CO₂-laser TO, a relatively novel procedure that

requires precision and familiarity with specific techniques to avoid complications and achieve optimal outcomes.

From a patient safety perspective, the protocol provides a standardized approach to CO₂-laser TO, which is important for reducing variability in surgical outcomes and complications. By following these steps, surgeons can minimize the risks associated with the procedure, such as post-operative bleeding and incomplete symptom resolution. Presenting these steps in a video and text format supports further dissemination of the technique, which could help its adoption in more clinical settings and thereby further contribute to advancements in tonsil surgery and the availability of tonsillotomy worldwide.

TRENDS IN THE INCIDENCE OF TONSIL COMPLAINTS IN ADULTS IN THE DUTCH POPULATION

In **Chapter 5**, we provide an overview of CO₂-laser TO designed to inform and educate Dutch medical professionals about this innovative surgical technique. Additionally, we examine trends in the incidence of tonsil-related complaints and surgery among adult patients in the Netherlands over the past decade. The data reveals a stable yearly incidence of tonsil complaints, which continues to place a significant burden on healthcare services. Between 2012 and 2019, an average of 73,887 adult cases of “diseases of the adenoid or tonsils” were diagnosed annually, leading to approximately 11,130 TE’s per year. This comes down to about 8 TE procedures per 10,000 adults, underscoring that the demand for surgical intervention for tonsil complaints remains substantial.

These trends have significant implications for clinical practice, particularly in the surgical management of tonsil-related conditions. The stable rate of adult tonsillectomies indicates that TE remains a widely used treatment, likely due to its proven effectiveness. However, the ongoing demand for TE, along with its associated post-operative morbidity, prolonged recovery, and healthcare costs, underscores the need to explore alternative surgical options. CO₂-laser TO presents a promising alternative in this context.

SHORT-TERM EFFICACY, RECOVERY AND SAFETY OUTCOMES OF CO₂-LASER TONSILLOTOMY COMPARED TO TONSILLECTOMY

In **Chapter 2**, we reviewed existing literature suggesting that TO could be a viable alternative to TE in adults, which included our pilot study presented in **Chapter 3**. This

study indicated that CO₂-laser TO could offer favorable outcomes in terms of recovery, postoperative pain, and complications, with similar short-term effectiveness. However, it became clear that more scientifically robust evidence was necessary. Thus, we initiated the **TOMTOM-study**, a large multicenter randomized controlled trial to compare the recovery, complications, efficacy, and cost-effectiveness of both interventions.

In **Chapter 6**, we present the first results of the TOMTOM-study, which involved 199 adult patients across five hospitals in the Netherlands. The trial compared the efficacy and safety of CO₂-laser TO and traditional TE. The results show that while both procedures are effective, there are notable differences in recovery time, postoperative pain, and symptom persistence.

Patients undergoing TO experience a quicker functional recovery, with 77% fully recovered within two weeks, compared to 57% in the TE group. Additionally, TO patients returned to work sooner, with a median of 4.5 days versus 12.0 days for TE patients. The faster recovery was also accompanied by significantly lower postoperative pain and reduced use of analgesics in the TO group, which is in line with the less invasive nature of the procedure.

However, the study also found that while TO resulted in a quicker and less painful recovery, it was associated with a higher rate of persistent symptoms six months post-surgery. Specifically, 57% of TO patients reported persistent symptoms, compared to 35% in the TE group. The intensity of these persistent symptoms was generally below the clinically relevant threshold, and thus overall patient satisfaction remained high in both groups.

These outcomes suggest that while TO offers significant advantages in terms of recovery and comfort, it may be less effective in fully resolving tonsil-related complaints compared to TE, but the clinical implications of remaining symptoms seem limited.

LONG-TERM EFFECTIVENESS AND COST-EFFECTIVENESS OF TONSIL-LOTOMY COMPARED TO TONSILLECTOMY

After finding out in **Chapter 6** that CO₂-laser TO is a safe and effective treatment for tonsil complaints in the short term, with fewer complications and quicker recovery compared to TE, the question arises whether CO₂-laser TO is also effective in the long term. Additionally, to determine if CO₂-laser TO has value in the clinic as a viable alternative to TE, its cost-effectiveness is crucial because it influences decision-making in healthcare,

particularly in balancing patient outcomes with the efficient allocation of healthcare resources.

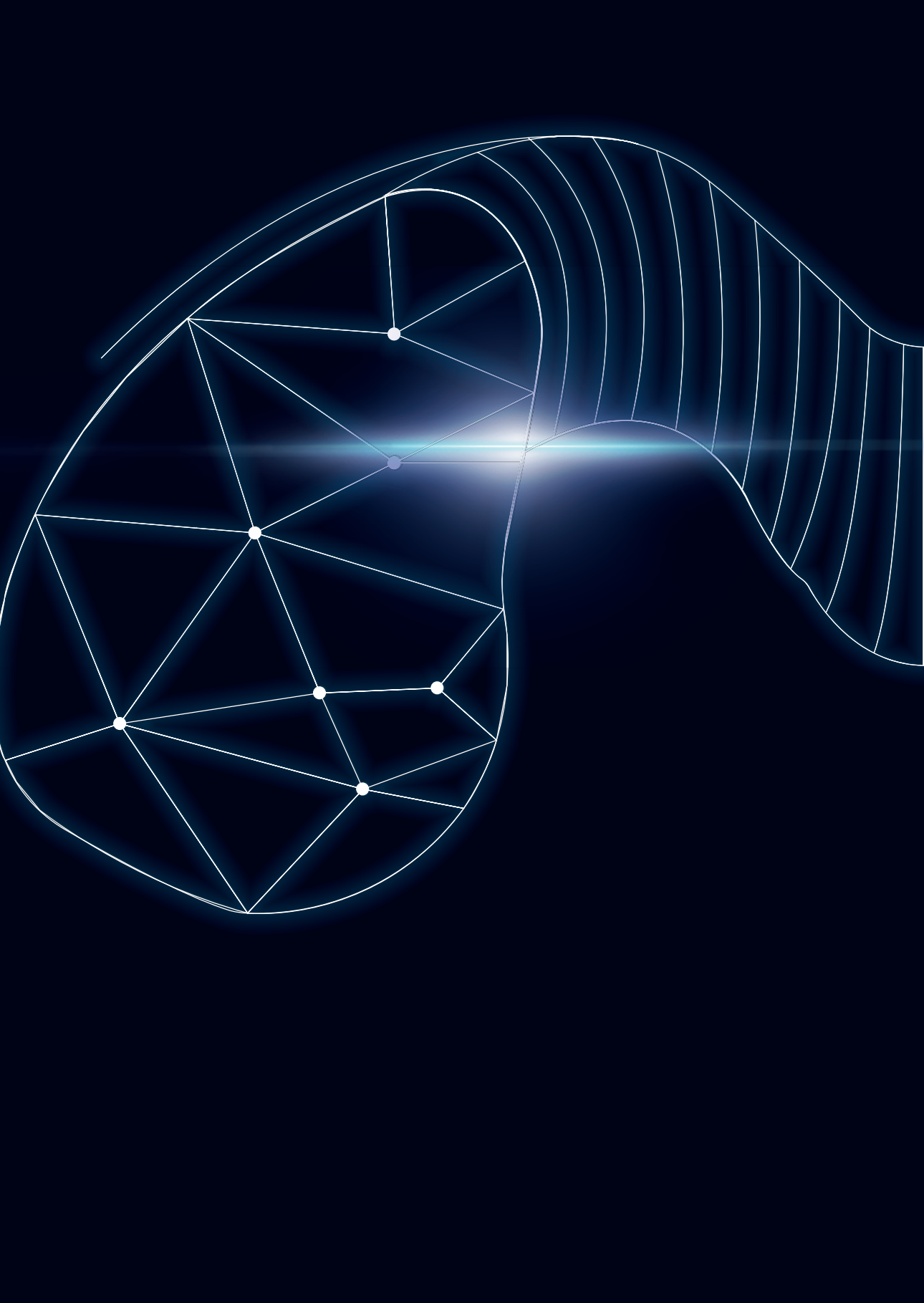
The TOMTOM study therefore extended the investigation into the long-term effectiveness and cost-effectiveness of CO₂-laser TO compared to TE in adults, as presented in **Chapter 7**.

At one year and two years post-surgery, the study found that TE was more effective in resolving the primary tonsil-related complaints than CO₂-laser TO. Specifically, 25.2% of TE patients reported persistent complaints after one year, compared to 51.4% of TO patients. After two years, these figures were 19.7% for TE and 45.2% for TO. However, the severity of these persistent symptoms was significantly reduced in both groups, generally below clinically relevant thresholds. The quality of life improved over time. Interestingly, satisfaction with the procedure and the percentage of patients who would recommend the surgery to others did not differ between the two groups at one- and two-years post-surgery. The substantial symptom reduction, often below clinically relevant thresholds, in patients with remaining symptoms and the faster recovery time after CO₂-laser TO likely compensated for the difference in effectiveness between the procedures.

TO was significantly less costly than TE. The total cost per CO₂-laser TO procedure was less than half that of a TE procedure (€671 vs. €1824). When accounting for additional procedures and other healthcare costs, the total societal costs, including lost productivity, were also significantly lower for TO. This led to a 71% to 93% likelihood that CO₂-laser TO would be considered cost-effective compared to TE at the commonly accepted threshold in the Netherlands.

These findings suggest that while TE may offer slightly better long-term resolution of symptoms, CO₂-laser TO presents a cost-effective alternative with substantial benefits in terms of recovery time, reduced pain, and lower societal costs. The decision between TE and CO₂-laser TO should be based on patient characteristics and preferences. Careful patient selection and preoperative counseling are important to optimize outcomes and patient satisfaction.

This study's findings support the inclusion of CO₂-laser TO as a viable option in the therapeutic arsenal for managing tonsil-related afflictions in adults.



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