

Abstracts

WOLF TruBlue 445 nm Laser

July 2021



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Apr 2018

Hess, M.M., Fleischer, S. & Ernstberger, M.

New 445 nm blue laser for laryngeal surgery combines photoangiolytic and cutting properties

Eur Arch Otorhinolaryngol.

2018 Jun; 275(6): 1557-1567.29675755

<https://doi.org/10.1007/s00405-018-4974-8>

Abstract Background: Photoangiolytic lasers have broadened the surgical armamentarium for many phonosurgical interventions. However, the pulse dye laser and potassium titanyl phosphate (KTP) laser have technical drawbacks and a smaller spectrum of indications.

Methods and results: The new 445 nm wavelength laser, the so-called 'blue laser', proves to show tissue effects comparable to the KTP laser and is also capable of treating subepithelial vessels due to its photoangiolytic properties, it can coagulate and carbonize at higher energy levels, and can be used via glass fibers in non-contact and contact mode for in-office procedures.

Discussion: In contrast to the KTP, the new 445 nm laser can also be used as a cutting laser, thus combining very much wanted properties of diode or CO₂ lasers with photoangiolytic lasers. Further advantages of the new laser are the: (1) portability of the shoe box sized, shock-proof laser machine for in-office and operating room usage, (2) the selection of pulse rates from continuous wave (cw) to less than a millisecond, (3) stronger tissue effects compared to KTP with similar energy and pulse settings, (4) far better cutting properties than the KTP, and thus (5) more possibilities for usage in laryngology as well as in other fields or surgery.

Conclusion: We demonstrate the feasibility of the 445 nm laser in several laboratory experiments and show clinical cases where photoangiolysis and cutting was possible. However, this is a preliminary report and further systematic studies in greater numbers are warranted.

Keywords: 445 nm wavelength; Blue laser; Laryngology; Laser surgery; Office based surgery; Phonosurgery; Photoangiolysis.

July 2019

H.M. Diab 1,2, N.A. Daikhes 1, P.U. Umarov 1, O.A. Pashchinina 1, D.A. Zagorskaya 1

The use of photoangiolytic laser in the surgical treatment of temporal bone paraganglioma

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Abstract Background: Over the past few decades, laser surgery has completely changed the clinical practice of doctors of various specialties, including otorhinolaryngologists.

Material and methods: Surgical treatment of a 42-year-old woman with a diagnosis of type A temporal paraganglioma was performed on the basis of the FBSI SCCO. We used the settings of the 445 nm high-power photoangiolytic laser and shortened the working cycles at the highest power of 10 W; a very short time duration of impulses and a distance of 1–3 mm from the target tissue was used for photoangiolysis.

Results: The tumor of the right middle ear was revealed on the X-ray examination (MSCT of the temporal bones). During revision of the tympanic cavity under conditions of moderate bleeding, a tumor was removed while maintaining the auditory ossicles. The vessels supplying the tumor were coagulated using a photoangiolytic laser with a wavelength of 445 nm.

Conclusions: The ability to remove a tumor of the middle ear with minimal blood loss in the pre- and postoperative periods without damaging the surrounding structures of the inner and middle ear was achieved. In the future, it is planned to conduct an analysis of long-term postoperative changes both at the tissue and functional levels. Such data can only be obtained after 36 months from the date of the operation, and after the sufficient number of operations using this technique will be reached used via glass fibers in non-contact and contact mode for in-office procedures.

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Jan 2020

Strieth, S., Hagemann, J. & Hess, M.

Angiolytic laser applications for the larynx; Phonosurgical concepts for transoral laser microsurgery

HNO. 2020 Jan; 68(1):59-68. German. 31950226
<https://doi.org/10.1007/s00106-019-00801-3>

Abstract: Transoral laser microsurgery (TLM) for treatment of laryngeal cancer has reduced temporary tracheotomies, increased organ preservation rates, and improved functional results. Gold standard for laser-based transoral resection of laryngeal cancer is the application of CO₂ lasers. Oncologically safe radical resection and postoperative voice outcome must be weighed up individually. Angiolytic laser effects enable modification of the tumor microenvironment by targeted obliteration of microvessels and antagonization of angiogenesis with preservation of vibrating laryngeal tissue for good voice function. Introduction of the German S3 guideline on diagnosis, treatment, and follow-up of laryngeal cancer is a critical step towards national evidence-based standardization. Internationally, the evidence for treatment of laryngeal mucosal dysplasia and T1a cancer with angiolytic potassium titanyl phosphate (KTP) lasers is increasing. Angiolytic lasers are also used for juvenile papillomatosis and suspension microlaryngoscopy under general anesthesia or local anesthesia in selected patients.

Keywords: KTP; Laryngeal cancer; Laryngeal papillomatosis; TLM; Voice.

January 2020

Markus M Hess | Susanne Fleischer

Percutaneous fibre guided laser surgery of the endolarynx

<https://www.entandaudiologynews.com/development/how-i-do-it/post/percutaneous-fibre-guided-laser-surgery-of-the-endolarynx>

Occasionally, getting access to the larynx for an intervention can be challenging. Markus Hess and Susanne Fleischer

describe a novel way to perform laser treatment in such difficult instances.

Method and results: Our patient (male, aged 33) with progressive adult onset recurrent respiratory papilloma (RRP) could not be treated satisfactorily with in-office transnasal fibre guided photoangiolytic laser surgery due to pronounced gag response and hypersalivation and, unfortunately, his larynx also could not be entirely exposed during direct suspension microlaryngoscopy.

A laser glass fibre could easily be advanced and retracted within the cannula and its tip was proud of the tip of the cannula bevel by a few millimetres. This is always visualised on the monitor. With joystick-like movements of the cannula's hub combined with advancement or retraction of the glass fibre, the glass fibre tip could be positioned close to or into the papilloma tissue at different endolaryngeal sites. With a photoangiolytic laser at 445nm wavelength (WOLF TruBlue®, A.R.C. Laser Comp, Nuremberg, Germany) we treated RRP at different sites, including the free edge of both vocal folds, inferior aspects of vocal folds, ventricular folds, inside of Morgagni's ventricles, and papilloma within the anterior commissure. We used various laser effects such as photoangiolysis, coagulation, carbonisation, and vaporisation (see also Hess et al [1]; Mallur et al [2]). For all laser applications during anaesthesia, laser safety precautions were complied with, especially lowering of ventilation oxygen saturation far below 50% during anaesthesia.

“The technique allows one to deliver laser light into the larynx via glass fibre in cases where office-based indirect surgery, as well as direct microlaryngoscopy, are not possible”

Conclusions: In patients with difficult-to-expose larynges in suspension microlaryngoscopy and impossible transnasal or transoral office laser approach, this new percutaneous laser technique can be a very helpful alternative to achieve access to the endolarynx while avoiding open neck surgery. A 20G cannula serves as an introduction tool and joystick-like guiding instrument, enabling access even to endolaryngeal regions that cannot be accessed easily in transnasal flexible channelled endoscopy or in direct microlaryngoscopy. This approach extends our armamentarium for endolaryngeal surgery.



Aug 2020

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Blue Light Laser Results in Less Vocal Fold Scarring Compared to KTP Laser in Normal Rat Vocal Folds

Laryngoscope. 2021 Apr;131(4):853-858. 32750168 <https://doi.org/10.1002/lary.28892>

Abstract Objectives: Preliminary investigations suggest that a novel blue light (BL) laser with a wavelength of 445 nm is comparable to the commonly utilized potassium titanyl phosphate (KTP) laser (532 nm) for treatment of various laryngeal pathologies. The objective of the current study is to make a direct histological comparison of the degree of vocal fold scarring after either BL or KTP laser treatment in an animal model.

Study design: This was a randomized controlled study using rats.

Methods: Twenty-four Sprague-Dawley rats were randomized to BL or KTP laser treatment. Laser was delivered in non-overlapping pulses to normal rat vocal folds. Larynges in each group were harvested at three time points: post-operative day 1, 30, and 90. Three animals served as negative controls. The excised whole larynges were sectioned transversely and stained with hematoxylin/eosin and trichrome. Presence of subepithelial inflammation and protein deposition/fibrosis indicative of scarring were scored semi-quantitatively (from grade 1-3) by two pathologists blinded to treatment groups.

Results: Between-group comparison showed that both laser treatments resulted in significantly elevated subepithelial protein deposition/fibrosis 90 days after treatment compared to negative controls (BL: 2 ± 0 ; KTP: 2.67 ± 0.29 ; control: 1.17 ± 0.29 ; $P < .05$). However, the degree of protein deposition/fibrosis was significantly higher in the KTP group compared to the BL group ($P = .016$). Within-group comparison showed that the KTP group showed evidence of fibrosis as early as 30 days after treatment, which was not observed in the BL group.

Conclusions: The current study suggests that the degree of scarring is significantly less after BL laser treatment compared to KTP in normal rat vocal fold tissue.

Level of evidence: NA

Laryngoscope, 131:853-858, 2021.

Keywords: Blue light laser, KTP laser, vocal fold scar, larynx, voice, scarring. © 2020 The American Laryngological, Rhinological and Otological Society, Inc.

Sep 2020

Markus Hess , Susanne Fleischer

Photoangiolytic Lasers in Laryngology

Laryngorhinootologie. 2020 Sep;99(9):607-612. German. 32851626 <https://doi.org/10.1055/a-1071-0410>

Abstract With photoangiolytic lasers like KTP (Potassium-Titanyl-Phosphate, 532 nm) lasers or the new „blue“ laser (445 nm), even the smallest vessels and capillaries within the vocal fold can be treated without destroying the covering epithelium. This enables effective treatment of benign and malignant sub- and intraepithelial lesions of the vocal folds such as papilloma, edema, polyps, leukoplakia, dysplasia and capillary vessels while preserving the vibratory properties of the different layers of the lamina propria. Because photoangiolytic laser light can be routed through tiny glass fibers, office-based surgery with channelled flexible endoscopes are feasible as well as phonomicrosurgical operations under general anesthesia. Furthermore, the so called „blue“ laser can cut tissues and thus broadens the technical armamentarium of the phonosurgeon.

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Feb 2021

Karkos PD, Koskinas IS, Triaridis S, Constantinidis J.

Lasers in Otolaryngology: A Laser Odyssey From Carbon Dioxide to True Blue

Ear Nose Throat J. 2021 Feb;
100(1_suppl):1S-3S. 32845805
<https://doi.org/10.1177/0145561320951681>

Abstract: In this special issue of the Ear Nose and Throat (ENT) journal entitled Lasers in Otolaryngology, we attempted to cover and accommodate different experiences from around the globe on both established and some not so well-known techniques and indications for Lasers in most ENT subspecialties. Despite the COVID 19 pandemic, authors from all over the world have expressed their interest in publishing their Laser experiences with ENT journal and for this we are very grateful.

Keywords: ear nose throat; larynx; lasers; otolaryngology.

Feb 2021

Miller BJ, Abdelhamid A, Karagama Y.

Applications of Office-Based 445 nm Blue Laser Transnasal Flexible Laser Surgery: A Case Series and Review of Practice

Ear Nose Throat J. 2021 Feb;
100(1_suppl):105S-112S. 32970490
<https://doi.org/10.1177/0145561320960544>

Abstract Background: The recent introduction of 445 nm blue laser to office-based laryngology presents potential advantages. These include a desirable combination of cutting and photoangiolytic qualities and a lightweight, shock-resistant design. Despite its increasing use, current evidence is limited to experimental data and case reports.

Objectives: The authors present a case series and overview of office blue laser transnasal flexible laser surgery (TNFLS), considering indications, patient selection, safety, technique, and surgical outcomes. We also review the safety and relevance of TNFLS to the ongoing coronavirus pandemic.

Methods: Retrospective case series and narrative review. Our primary outcome measure was preoperative and postoperative Voice Handicap Index (VHI-10) score. Complications were documented by nature and severity.

Results: Thirty-six cases of office blue laser TNFLS were performed. A statistically significant improvement in VHI-10 score was demonstrated in cases of recurrent respiratory papillomatosis (RRP) and benign laryngeal lesions causing dysphonia ($P < 0.01$ and 0.045). Blue laser also proved effective in assisting office biopsy procedures. A minor and self-limiting complication was reported.

Conclusions: Office blue laser TNFLS is safe and effective in the treatment of RRP and a range of benign laryngeal lesions. Future research should compare the efficacy and safety of blue laser with potassium titanyl phosphate laser in office-based treatment of these conditions. Further assessment of the cutting qualities of blue laser, initially in the theater environment, is necessary to refine our understanding of future applications.

Keywords: laryngology; laser surgery; office laser surgery; office procedures; phonosurgery; transnasal flexible laser surgery.

May 2021

Abdul Latif Hamdan, Anthony Ghanem

Un-sedated Office-Based Application of Blue Laser in Vocal Fold Lesions

<https://doi.org/10.1016/j.jvoice.2021.03.031>

Introduction: Office-based laser procedures in laryngology have gained a lot of popularity in the last decade with the use of the KTP, PDL and Thulium lasers. Preliminary investigations currently report on the use of the 445 nm wavelength Blue laser for the treatment of various laryngeal pathologies, given its dual photoangiolytic and cutting properties.

Objective: We aim to investigate the safety and efficacy of the Blue laser for the treatment of vocal fold lesions.

Methods: This is a retrospective chart review of eleven patients with a variety of vocal fold lesions (polyps, Reinke's edema, papilloma, and leukoplakia), that underwent un-sedated office-based treatment using the 445 nm blue

laser. The primary outcome was to compare preoperative to postoperative Voice Handicap Index (VHI-10) score and self-reported voice improvement using a visual analog scale (VAS). We also compared fiberoptic laryngeal examination before and after treatment.

Results: Eleven un-sedated office-based procedures using the blue laser were performed. There was improvement in the mean VHI-10 score ($n = 8$) with a decrease from 15.13 ± 8.77 to 3.50 ± 3.46 ($P = 0.015$). Similarly, the mean VAS score ($n = 7$) decreased from 6.14 ± 1.21 to 1.71 ± 1.60 ($P < 0.003$). All patients had a complete or partial regression of the vocal

fold lesions on fiberoptic laryngeal examination. None of the patients had complications after the procedure.

Conclusion: Blue laser therapy can be suggested as a safe and effective alternative treatment modality in office-based laryngology procedures for a variety of vocal fold lesions. A larger series is needed to better validate the efficacy of this laser as a new treatment modality.

Key Words: Blue laser, Laryngology, Office-based procedures, VHI-10

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Nguyen DD, Pang JY, Madill C, Novakovic D.

Effects of 445-nm Laser on Vessels of Chick Chorioallantoic Membrane with Implications to Microlaryngeal Laser Surgery

Laryngoscope. 2021 Jun;
131(6):E1950-E1956. 33459366
<https://doi.org/10.1002/lary.29354>

Abstract Objective: Previous research has shown that effective application of angiolytic lasers in micro-laryngeal surgery is determined by wavelength, pulse width (PW), and fluence. Recently, a 445-nm (blue) laser (BL) has been developed with a potentially greater hemoglobin absorption than previous lasers. The chick chorioallantoic membrane (CAM) represents a suitable model for testing various settings to find out the most optimal settings of this laser. This study used the CAM model to examine whether successful photoangiolytic effects could be obtained using BL

Methods: Seven hundred and ninety three third-order vascular segments of viable CAM were irradiated using BL via 400- μ m diameter fiber, 1 pulse/second, with PW and power varied systematically at standardized fiber-to-vessel distances of 1 and 3 mm. Outcome measures including vessel ablation rate (AR), rupture rate (RR), and visible tissue effects were analyzed using Chi-square test.

Results: Energy levels of 400, 540, and 600 mJ (per pulse) were most effective for vessel ablation. A working distance of 3 mm resulted in higher ablation and less vessel rupture compared with 1 mm at these optimal energy levels. At

3 mm, a longer PW resulted in higher AR. At 1 mm, AR increased with shorter PW and higher power. The 1-mm working distance resulted in lower tissue effects than 3 mm.

Conclusion: Findings in this study showed that BL was effective in vessel ablation using relevant combination of working distance, PW, and energy levels. To obtain high AR, longer working distance plus longer PW was required and if working distance was reduced, shorter PW should be set.

Level of evidence: NA

Laryngoscope, 131:E1950-E1956, 2021.

Keywords: 445-nm laser; Blue laser; chick chorioallantoic membrane; microlaryngeal surgery; photoangiolytic.

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