Prior Authorization Review
Panel MCO Policy Submission

A separate copy of this form must accompany each policy submitted for review. Policies submitted without this form will not be considered for review.

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Type of Submission – Check all that apply:
- [ ] New Policy
- [x] Revised Policy*
- [ ] Annual Review – No Revisions

*All revisions to the policy must be highlighted using track changes throughout the document. Please provide any clarifying information for the policy below:

CPB 0354: Yag Laser in Ophthalmology and Other Selected Indications

This CPB has been revised to state that the following are considered experimental and investigational: (i) Er:YAG laser for the treatment of psoriasis; and (ii) Nd:YAG laser for the treatment of basal cell carcinoma, gastrointestinal tumors, nail psoriasis, and pancreatic cancer.

Name of Authorized Individual (Please type or print): Dr. Bernard Lewin, M.D.
Signature of Authorized Individual: [Signature]

www.aetnabetterhealth.com/pennsylvania
Revised 06/01/2018
YAG Laser in Ophthalmology and Other Selected Indications

Policy

Aetna considers Nd:YAG laser capsulotomy medically necessary when performed following cataract extraction in members with visually significant clouding (opacification) of the posterior portion of the membrane that surrounds the lens (the posterior capsule) according to the following selection criteria based on the clinical guidelines of an expert panel on cataract surgery convened by the Agency for Health Care Policy and Research (AHCPR, 1993):

Please see amendment for Pennsylvania Medicaid at the end of this CPB.
I. After cataract removal in the same eye, unless the laser capsulotomy is scheduled at the same time as cataract removal surgery, or performed prophylactically.

II. When performed within 6 months of surgery only if one of the following medical necessity criteria is met:

A. The member has a best-corrected visual acuity (BCVA) of 20/50 or worse and both of the following conditions are met:
   1. The eye examination confirms that posterior capsular opacification is present; and
   2. The visual impairment has interfered with the member's ability to carry out needed or desired activities; or

B. The member has a BCVA of 20/40 or better and all of the following conditions are met:
   1. The eye examination confirms that posterior capsular opacification is present; and
   2. Visual disability fluctuates as a result of symptoms of glare or symptoms of decreased contrast; and
   3. Visual disability has interfered with the member's ability to carry out needed or desired activities; or

C. When used for members with posterior capsular opacification regardless of functional impairment for any of the following reasons:
1. To provide better visualization of the posterior pole for members with:
   a. Diabetic retinopathy; or
   b. Macular disease; or
   c. Retinal detachment; or

2. To diagnose posterior pole tumors; or
3. To evaluate the optic nerve head.

If none of the above criteria is met, Nd:YAG laser capsulotomy performed within 6 months of cataract surgery is considered experimental and investigational because of a lack of evidence of the value of routine prophylactic capsulotomy following cataract surgery.

**Note:** Because posterior capsular opacification is uncommon within 6 months after cataract surgery, requests for Nd:YAG laser capsulotomy performed within 6 months of cataract surgery of the same eye may be subject to medical necessity review.

Aetna considers Nd:YAG laser peripheral iridotomy medically necessary for primary angle closure and primary angle-closure glaucoma.

Aetna considers ND-YAG laser goniotomy medically necessary for the treatment of primary congenital glaucoma.

Aetna considers Nd:YAG laser vitreolysis experimental and investigational for the treatment of vitreous degeneration and vitreous floaters because its effectiveness for these indications has not been established.
Aetna considers Nd:YAG laser anterior hyaloidotomy experimental and investigational for the treatment of trapped triamcinolone behind the lens after intra-vitreal injection because its effectiveness for this indication has not been established.

Aetna considers Nd:YAG laser peripheral iridotomy experimental and investigational for the prevention of pigment dispersion glaucoma because its effectiveness for this indication has not been established.

Aetna considers Nd:YAG laser posterior hyaloidotomy experimental and investigational for the clearance of pre-macular hemorrhages because its effectiveness for this indication has not been established.

Aetna considers Nd:YAG laser goniopuncture experimental and investigational for rescue of failed trabeculectomy because its effectiveness for this indication has not been established.

Aetna considers Nd:YAG laser experimental and investigational for the treatment of the following non-ophthalmological indications because its effectiveness for these indications has not been established (not an all-inclusive list):

- Basal cell carcinoma
- Benign prostatic hyperplasia (for Holmium:YAG laser (HoLAP) for BPH, see CPB 0079 - Benign Prostatic Hypertrophy Treatments)
- Chronic periodontitis
- Disc decompression
- Gastro-intestinal tumors
• Infantile hemangioma
• Nail psoriasis
• Onychomycosis
• Pancreatic cancer
• Peri-implantitis
• Port wine stain
• Recurrent aphthous stomatitis

Aetna considers Er:YAG laser experimental and investigational for the treatment of the following non-ophthalmological indications because its effectiveness for this indication has not been established (not an all-inclusive list):

• Psoriasis
• Recurrent aphthous stomatitis
• Urinary incontinence

Background

The Agency for Health Care Policy and Research (AHCPR) panel concluded that laser capsulotomy should not be scheduled at the time cataract surgery is performed because one can not predict whether a cataract surgery patient will develop posterior capsular opacification or the time at which any such opacification will occur. For similar reasons, manual removal of the posterior capsule, performed with a needle or hook (called corneo-scleral section), should not be routinely performed at the time of initial cataract surgery.

The AHCPR panel also concluded that neodymium:yttrium-aluminum-garnet (Nd:YAG) laser capsulotomy should not be performed prophylactically or scheduled routinely at particular times after cataract surgery.
The eye examination should confirm the diagnosis of posterior capsular opacification and exclude other ocular causes of functional impairment. The panel concurred with the finding of the literature review that there is yet no objective method of relating the degree of capsular opacification to the severity of functional impairment.

The panel also concluded that posterior capsular opacification rarely occurs within 3 months of surgery, and that it is uncommon for posterior capsular opacification to occur within the first 6 months of surgery. Therefore, any cases of Nd:YAG laser capsulotomy occurring within 6 months of cataract surgery should be reviewed, to ensure that Nd:YAG laser capsulotomy is reasonable and medically necessary.

In a single center retrospective study, Delaney and colleagues (2002) determined the effectiveness of Nd:YAG vitreolysis and pars plana vitrectomy in the treatment of vitreous floaters. A total of 31 patients (42 eyes) who underwent 54 procedures (Nd:YAG vitreolysis or pars plana vitrectomy) for the treatment of vitreous floaters were included in the study. Main outcome measures were percentage symptomatic improvement following treatment and incidence of post-operative complications. Statistical analysis was performed using the Fisher exact test. Posterior vitreous detachment was the primary cause of floaters in all 42 eyes with co-existing vitreous veils in 3 eyes and asteroid hyalosis in 2 eyes. Thirty-nine of 42 eyes received Nd:YAG vitreolysis; 38 % found Nd:YAG vitreolysis moderately improved their symptoms while 62 % found no improvement.
After an average of 14.7 months follow-up, no post-operative complications were recorded. Fifteen eyes underwent a pars plana vitrectomy, 1 with combined phaco-emulsification and posterior chamber implantation and 11 following unsuccessful laser vitreolysis. Pars plana vitrectomy resulted in full resolution of symptoms in 93% of eyes. One patient developed a post-operative retinal detachment which was successfully treated. The authors concluded that patients' symptoms from vitreous floaters are often under-estimated resulting in no intervention. This paper showed Nd:YAG vitreolysis to be a safe but only moderately effective primary treatment conferring clinical benefit in 1/3 of patients.

Kirwan and Cahill (2011) reported on a case of successful drainage of a large pre-macular hemorrhage using laser photo-disruption of the posterior hyaloid membrane. A 47-year old man presented acutely to the authors' emergency department complaining of a 24-hr history of sudden onset, painless and persistent loss of vision in his left eye. Immediately before noticing this loss of vision, he had been vomiting violently from excessive alcohol intake. The left visual acuity was counting fingers. Dilated fundoscopy of the left eye revealed a large pre-macular hemorrhage that was 14 disc diameters in size. Clotting investigations were normal. A diagnosis of valsalva retinopathy was made and the patient elected to receive a prompt Nd:YAG laser posterior hyaloidotomy as an outpatient. At 1 week follow-up, the hemorrhage had drained completely into the vitreous space revealing a healthy macula and the visual acuity had improved to 6/12 unaided. At 6-month
follow-up the left visual acuity stabilized at 6/9 unaided. The authors concluded that Nd:YAG laser posterior hyaloidotomy is an useful outpatient procedure for successful clearance of large pre-macular hemorrhages that offers patients rapid recovery of visual acuity and the avoidance of more invasive intra-ocular surgery. The findings of this case study (with short-term follow-up) needs to be validated by well-designed studies.

In a prospective, randomized, controlled trial, Scott et al (2011) tested the hypothesis that Nd:YAG laser peripheral iridotomy (LPI) significantly reduces the incidence of conversion from pigment dispersion syndrome (PDS) with ocular hypertension (OHT) to pigmentary glaucoma (PG). A total of 116 eyes of 116 patients with PDS and OHT were used in this analysis. Patients were assigned randomly either to Nd:YAG LPI or to a control group (no laser). The primary outcome measure was conversion to PG within 3 years, based on full-threshold visual field (VF) analysis using the Ocular Hypertension Treatment Study criteria. Secondary outcome measures were whether eyes required topical anti-glaucoma medications during the study period and the time to conversion or medication. Fifty-seven patients were randomized to undergo laser treatment and 59 were randomized to no laser (controls). Age, gender, spherical equivalent refraction, and intra-ocular pressure at baseline were similar between groups. Outcome data were available for 105 (90 %) of recruited subjects, 52 in the laser treatment group and 53 in the no laser treatment group. Patients were followed-up for a median of 35.9 months (range of 10 to 36
months) in the laser arm and 35.9 months (range of 1 to 36 months) in the control arm. Eight eyes (15%) in the laser group and 3 eyes (6%) in the control group converted to glaucoma in the study period. The proportion of eyes started on medical treatment was similar in the 2 groups: 8 eyes (15%) in the laser group and 9 eyes (17%) in the control group. Survival analyses showed no evidence of any difference in time to VF progression or commencement of topical therapy between the 2 groups. Cataract extraction was performed on 1 patient in the laser group and in 1 patient in the control group during the study period (laser eye at 18 months; control eye at 34 months). The authors concluded that the findings of this study suggested that there was no benefit of Nd:YAG LPI in preventing progression from PDS with OHT to PG within 3 years of follow-up.

Ascaso and colleagues (2012) reported on the case of a 65-year old male who underwent intra-vitreal triamcinolone acetonide (IVTA) injection for treating a clinically significant macular edema (CSME) due to background diabetic retinopathy in his left eye. On the first post-operative day, visual acuity dropped from 20/80 to hand movements. Slit-lamp examination showed the drug between the posterior capsule of the lens and the anterior hyaloid face. Two weeks later, visual acuity and the milky fluid seemed unchanged. Neodymium:yttrium-aluminum-garnet laser anterior hyaloidotomy was performed. One week later, slit-lamp examination of the retro-lental space revealed the complete disappearance of triamcinolone and intra-ocular pressure remained stable. After a follow-up period of 2 months, visual acuity
increased to 20/50 with the lens remaining clear. The authors concluded that Nd:YAG laser anterior hyaloidotomy is an effective, simple, useful and minimally invasive outpatient procedure in patients with persistent entrapment of triamcinolone behind the crystalline lens, allowing the drug to clear without trauma to the lens. The findings of this case study (with short-term follow-up) needs to be validated by well-designed studies.

Ramani et al (2009) examined the morphologic changes in the anterior segment of primary angle closure suspects (PACS) who underwent laser peripheral iridotomy (LPI) for a period of 2 years. Primary angle closure suspects (n = 82 eyes) of Asian Indian origin underwent A-scan biometry and ultrasound biomicroscopy. Anterior chamber depth, anterior chamber angle (ACA), axial length, lens thickness, relative lens position, central corneal thickness, angle opening distance 500, trabecular-ciliary process distance, iris-ciliary process distance, and iris thickness were measured before LPI and after LPI at 1 week, 6 months, 1 year, 1.5 years, and 2 years. Variation in the parameters measured over a period of 2 years was analyzed. Fifteen eyes out of 52 eyes developed into primary angle closure (PAC) with synechial changes. Univariate analysis for the predictive factors of PAC showed no significant association for age, sex, narrow angle, ultrasound biomicroscopy parameters, and vertical cup-disc ratio. When analyzed as continuous variables, decreasing ACA was significant risk factor (95 % confidence interval [CI]: 0.703, 0.989, p = 0.037). Iris-ciliary process distance, ACA, lens thickness, and angle opening distance 500 were the parameters that
varied significantly (p < 0.05) between "before LPI group" and "after LPI groups". None of the subjects developed increased intra-ocular pressure (IOP) after laser iridotomy. The authors concluded that in this hospital-based study on the course of PACS subjects after LPI, as many as 28% progressed to PAC. Decreasing ACA was the predictive factor for the progression of PACS to PAC. There was no increase in IOP, history, or symptoms of acute attack of glaucoma among the study subjects after LPI.

In a case-series study, Lin and colleagues (2011) evaluated the long-term changes in anterior segment morphology by using ultrasound biomicroscopy (UBM) following LPI in eyes with PAC. A total of 54 eyes with PAC of 31 consecutive patients were enrolled. Routine ophthalmic and UBM examination were performed at visit-1 (before LPI), 2 weeks, 6, and 12 months after LPI. The parameters of anterior chamber were measured by UBM and calculated. Results of each follow-up time were analyzed using repeated measures analysis of variance. Parameters of UBM measurement at 750 µm anterior to the sclera spur and at 500 µm counterpart were compared using paired student t-test. Compared to before LPI, anterior chamber depth (ACD) was deepened by approximate 0.10 mm after LPI, however, it was not statistically significant (F = 3.50, p > 0.05). Angle opening distance (AOD), trabecular-iris angle (TIA), angle recess area (ARA) and trabecular-ciliary process distance (TCPD) were significantly increased at 2 weeks, 6 and 12 months after LPI compared with respective baseline [AOD750: (165.0 ± 70.3), (185.8 ± 68.5), (196.1 ± 77.7) µm versus (66.2 ± 51.6) µm, F =
92.60; TIA750: 14.1° ± 6.3°, 15.5° ± 6.2°, 16.4° ± 5.9° versus 6.4° ± 4.9°, F = 92.60; ARA: (0.058 ± 0.024), (0.065 ± 0.023), (0.068 ± 0.026) mm(2) versus (0.025 ± 0.017) mm(2), F = 92.60; TCPD: (647.1 ± 113.0), (701.8 ± 93.4), (670.1 ± 95.4) µm versus (571.0 ± 97.2) µm, F = 34.00; p < 0.05]. The parameters of UMB measurement at 750 µm were significantly increased more than that at 500 µm anterior to the sclera spur (AOD: t = 5.90, TIA750: t = 2.70, p < 0.05; ARA: t = 2.00, p = 0.05).

The authors concluded that LPI can significantly widen the peripheral anterior angle in eyes with PAC lasting for at least 1 year after LPI. Parameters detected by UBM at 750 µm anterior to the sclera spur appear to be more sensitive in evaluating the alternation of peripheral angle structure.

The American Academy of Ophthalmology's Preferred practice pattern guidelines on "Primary angle closure" (AAO, 2010) stated that patients with PAC may have elevated IOP as a result of a chronic compromise of aqueous outflow due to appositional or synechial angle closure, or damage to the trabecular meshwork from previous intermittent acute angle-closure crisis. Iridotomy is indicated for eyes with PAC or primary angle-closure glaucoma (PACG).

A Medscape review on "Glaucoma, angle closure, chronic treatment & management" (Tham, 2012) stated that "Laser iridotomy is indicated for all stages of chronic angle-closure glaucoma (CACG). Laser iridotomy involves the creation of a hole in the peripheral iris by laser. The hole provides an alternative pathway for aqueous to flow from the posterior chamber into the anterior chamber, bypassing
the pupil. Therefore, iridotomy will eliminate pupillary block and prevent forward bowing of the iris as a result of the pressure difference between the two chambers. Iridotomy will open those areas of the angle not involved by PAS (peripheral anterior synechiae) and prevent further synechial closure”.

Thomas and Walland (2013) noted that PACG and its precursors represent both a significant proportion of world glaucoma blindness and a currently insurmountable burden of treatment. In contrast to primary open-angle glaucoma, preventive interventions in primary angle closure disease (PACD) can sometimes be definitive. These investigators have synthesized data from randomized controlled trials (RCT's) -- and where this is not available -- principles grounded in known biology, biological plausibility, logic, preferred practice and personal experience to develop detailed and explicit clinical algorithms for the management of the spectrum of PACD. Laser iridotomy is the mainstay of first-line intervention and is usually required for all PACD with the exception of some PACS. Laser iridotomy is a necessary but not always sufficient step and uncertainty arises where a patent iridotomy has not alleviated the angle closure profile or achieved clinically desired end points. The crucial step-wise considerations after iridotomy are: whether the angle is open or closed; whether the IOP can be medically controlled; the extent of PAS and the presence of visually significant cataract. These lead to further interventions that include iridoplasty, cataract surgery, trabeculectomy or phacotrabeculectomy. Such subsequent interventions are based on an arbitrary
threshold (180 degrees) for angle opening and extent of PAS following iridotomy and other initial procedures.

Furthermore, an UpToDate review on “Angle-closure glaucoma” (Weizer, 2013) states that “Laser peripheral iridotomy is the first step in treatment of patients with chronic angle closure glaucoma, to relieve any pupillary block component. The intraocular pressure may remain elevated, however, if scarring has already damaged the drainage angle. In this case, the remaining glaucoma is treated medically and surgically much as in open-angle glaucoma ....

Patients with signs and symptoms suggesting an acute attack of angle-closure glaucoma require emergency treatment by an ophthalmologist .... We recommend emergency use of topical ophthalmic medications to reduce intraocular pressure (Grade 1C). These drugs may include a beta-blocker, an alpha agonist, and an agent to produce miosis. We also suggest systemic medication to decrease intraocular pressure, which may include oral or IV acetazolamide, IV mannitol, oral glycerol, or isosorbide (Grade 2C). Once the acute attack is controlled, definitive treatment for angle-closure glaucoma is a laser peripheral iridotomy to provide a small drainage hole through the iris”.

Susanna et al (2014) stated that there is an increasing need to prolong trabeculectomy success rates with minimally invasive procedures. In a prospective, non-comparative, interventional cohort study, these researchers examined the safety and effectiveness of Nd:YAG laser goniopuncture (LGP) in IOP in eyes having late bleb failure following trabeculectomy with
mitomycin C administration. A total of 19 eyes of 19 patients with uncontrolled glaucoma after failed trabeculectomy were included in this study. All eyes had ischemic non-functioning blebs with patent internal ostia underwent Nd:YAG LGP, followed by a 5-fluorouracil injection. Main outcome measures were IOP and the number of anti-glaucoma medications before and after the procedure, as well as pre-surgical and postsurgical appearance of the blebs, using the Indiana Bleb Appearance Grading Scale classification. The mean (SD) time of LGP after trabeculectomy was 35.7 (32.3) months, and the mean (SD) follow-up period after LGP was 6.0 (1.1) months (range of 4.4 to 8.4 months). The mean (SD) IOP had decreased from 20.9 (4.5) mm Hg (range of 15.5 to 29.0 mm Hg) to 11.9 (4.1) mm Hg (range of 5.0 to 21.0 mm Hg) (p < 0.001). The only complications observed after LGP were 2 cases of hypotony, which resolved spontaneously. Compared with baseline Indiana Bleb Appearance Grading Scale classifications, 2 eyes showed an increase in bleb height and 10 eyes showed an increase in bleb extension. None of the eyes had a positive Seidel test result. The mean (SD) number of hypotensive agents per eye had decreased from 0.7 (1.1) to 0.3 (0.7) after the procedure. At the last follow-up visit, 15 eyes (79%) had achieved an IOP of 15 mm Hg or less, with a minimum IOP reduction of 20% from baseline without medication use. The authors concluded that the Nd:YAG LGP is a safe and effective procedure for lowering IOP in eyes with ischemic non-functioning blebs and patent trabeculectomy ostia. They stated that this is a promising solution to rescue failed trabeculectomies and can potentially prolong trabeculectomy success rates.
Guidelines from the World Glaucoma Association (2013) on childhood glaucoma state that angle surgery (goniotomy and trabeculotomy – conventional or circumferential) is the procedure of choice for primary congenital glaucoma with the exact choice dictated by corneal clarity and the surgeon’s experience and preference. The guidelines state that angle surgery success rates for secondary childhood glaucomas are generally not as good as for primary congenital glaucoma (PCG) with certain exceptions [e.g., glaucoma with acquired condition (uveitis) in juvenile idiopathic arthritis (JIA)].

In a Cochrane review, Ghate and Wang (2015) compared the safety and effectiveness of different surgical techniques for primary congenital glaucoma (PCG). These investigators searched CENTRAL (which contains the Cochrane Eyes and Vision Group Trials Register) (The Cochrane Library 2014, Issue 6), Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, Ovid MEDLINE Daily, Ovid OLDMEDLINE (January 1946 to June 2014), EMBASE (January 1980 to June 2014), (January 1982 to June 2014), PubMed (January 1946 to June 2014), the metaRegister of Controlled Trials (mRCT) (www.controlled-trials.com), ClinicalTrials.gov (www.clinicaltrials.gov), the WHO International Clinical Trials Registry Platform (ICTRP) (www.who.int/ictrp/search/en). They did not use any date or language restrictions in the electronic searches for trials. They last searched the electronic databases on June 23, 2014. These researchers included all randomized and quasi-randomized trials in which different types of surgical interventions were compared in children less than 5 years of
age with PCG. They used standard methodological procedures specified by The Cochrane Collaboration. A total of 6 trials (4 randomized and 2 quasi-randomized) with 102 eyes in 61 children were included in this analysis. Two trials were conducted in the USA and 1 trial each in Egypt, Israel, Lebanon and Saudi Arabia. All trials included children aged younger than 1 year when diagnosed with PCG, and followed them for periods ranging from 6 months to 5 years. No 2 trials compared the same pair of surgical interventions, so these researchers did not perform any meta-analysis. One trial compared trabeculotomy versus goniotomy; a 2nd trial compared combined trabeculectomy-trabeculotomy with mitomycin C versus trabeculectomy-trabeculotomy with mitomycin C and deep sclerectomy; a 3rd trial compared combined trabeculotomy-trabeculectomy versus trabeculotomy; a 4th trial compared 1 goniotomy versus 2 goniotomies; a 5th trial compared trabeculotomy versus viscocanalostomy; and the 6th trial compared surgical goniotomy versus neodymium-YAG laser goniotomy. For IOP change and surgical success (defined by IOP achieved), none of the trials reported a difference between pairs of surgical techniques. However, due to the limited sample sizes for all trials (average of 10 children per trial), the evidence as to whether a particular surgical technique is effective and which surgical technique is better, still remains uncertain.

Adverse events, such as choroidal detachment, shallow anterior chamber and hyphema, were reported from 4 trials. None of the trials reported quality of life or economic data. Overall, these trials were neither designed nor reported well. Two trials were quasi-randomized
trials and judged to have high risk of selection bias; 4 trials were at unclear or high risk for performance bias and detection bias; and these investigators judged 1 trial to have high risk of attrition bias due to high proportions of losses to follow-up. Due to poor study design and reporting, the reliability and applicability of evidence remain unclear. The authors concluded that no conclusions could be drawn from the trials included in this review due to paucity of data. They stated that more research is needed to determine which of the many surgeries performed for PCG are effective.

**Chronic Periodontitis:**

The American Dental Association Council on Scientific Affairs Expert Panel's clinical practice guideline on “The nonsurgical treatment of chronic periodontitis by means of scaling and root planing with or without adjuncts” (Smiley et al, 2015) listed neodymium:yttrium-aluminum-garnet (Nd:YAG) laser and scaling and root planing (SRP) as interventions that were considered but not recommended.

**Disc Decompression:**

Moon et al (2015) noted that laser ablation under an epiduroscopic view allows for the vaporization of a small amount of the nucleus pulposus, causing a reduction in intradiscal pressure and relief of radicular pain. Currently, Ho:YAG and Nd:YAG lasers are commonly used for spinal diseases. However, the use of the Nd:YAG laser for intra-spinal procedures can be limited because of thermal injury and low
efficacy. These researchers investigated the safety and effectiveness of epiduroscopic laser ablation using a 1,414-nm Nd:YAG laser; they examined if laser ablation was able to penetrate nucleus pulposus without heating surrounding tissues and without mechanical damage to surrounding tissue. Two live pigs, 3 porcine cadavers, and 2 human cadavers were used. For the in-vitro study, intradiscal and epidural pressure and temperature were compared in vertebral columns obtained from 3 porcine cadavers before and after laser ablation. For the in-vivo study, 2 pigs were used to simulate percutaneous epiduroscopic laser ablation. They were observed for behavioral changes and neurological deficits for 1 month after the laser ablation procedure. Two human cadavers were used for placing the laser fiber and epiduroscope in the correct target site through the sacral hiatus. Histological analysis was also performed to observe any damage around the ablated lesion. Both intradiscal and epidural pressure were markedly reduced immediately after laser ablation as compared with the pre-ablative state. The amount of the pressure decrease in the intradiscal space was significantly greater than that in the epidural space (45.8 ± 15.0 psi versus 30.0 ± 9.6 psi, p = 0.000). The temperature beneath the ipsilateral spinal nerve, which was the nearest site to the laser probe, never exceeded 40°C. Histology revealed no evidence of thermal damage to surrounding structures, including the spinal nerves, end-plates, and vertebrae, after laser ablation. All live pigs showed normal behavior without any sign of pain. In the human cadaveric study, there was no case of targeting failure or dural laceration. The mean time to reach the
target region was less than 5 minutes. The authors concluded that the 1,414-nm Nd:YAG laser can be used safely and effectively under the guidance of a spinal epiduroscope in an in-vivo porcine model and in a human cadaveric model. The main drawback of this study was that pressure measurements were performed on cadavers and not in-vivo. Cadaver models cannot account for intradiscal pressure changes that occur during live muscle contraction and different positions, which may affect results. Moreover, although these investigators controlled temperatures with heat baths, vascular and cerebrospinal fluid circulations were not simulated. Those circulations may change the temperature results in-vivo.

**Peri-Implantitis:**

Natto et al (2015) evaluated the effectiveness of various types of lasers (Nd:YAG, carbon dioxide [CO2], diode, erbium/chromium-doped yttrium-scandium-gallium-garnet [Er,Cr:YSGG], and erbium-doped yttrium-aluminum-garnet [Er:YAG]) in the treatment of peri-implantitis and their use in surgical and non-surgical procedures. Human studies for the treatment of peri-implantitis with laser therapy, published between 2002 and January 2014, were collected utilizing the electronic databases PubMed, Ovid, MEDLINE, Cochrane, and Google Scholar. Two reviewers conducted the study selection, data collection, and validity assessment. A total of 812 studies were selected in the initial title search; 13 studies were then chosen for this review. No human studies evaluated the effect of the Nd:YAG laser on peri-implantitis. The CO2 laser was reported to be safe and able to
enhance bone regeneration. The diode laser (980 nm) appeared to be effective in its bactericidal effect without changing the implant surface pattern. The Er,Cr:YSGG laser was reported to obtain bone regeneration around a failing implant in 1 case, while the Er:YAG laser exhibited a strong bactericidal effect against periodontopathic bacteria at a low energy level. The authors concluded that although lasers have shown promising results in reducing clinical signs of peri-implantitis, because of the limited sample sizes and short follow-up periods, no firm conclusion can be drawn at this moment. They stated that there is a need for more well-designed, longitudinal, RCTs.

**Urinary Incontinence:**

Ogrinc et al (2015) assessed the non-invasive erbium:yttrium-aluminum-garnet (Er:YAG) laser as a potential treatment strategy for stress urinary incontinence (SUI) and mixed UI (MUI). These researchers included 175 women (aged 49.7 ± 10 years) with newly diagnosed SUI (66 % of women) and MUI (34 %), respectively. Patients were clinically examined and classified by incontinence types (SUI and MUI) and grades (mild, moderate, severe, and very severe) using International Consultation on Incontinence Modular Questionnaire (ICIQ) and assessing Incontinence Severity Index (ISI). Using Er:YAG laser, these investigators performed on average 2.5 ± 0.5 procedures in each woman separated by a 2-month period. At each session, clinical examination was performed, ICIQ and ISI assessed and treatment discomfort measured with visual analog system (VAS) pain scale, and adverse effects and patients' satisfaction were
followed. Follow-ups were performed at 2, 6, and 12 months after the treatment. After the treatment, ISI decreased for 2.6 ± 1.0 points in patients diagnosed with mild UI before the treatment, for 3.6 ± 1.4 points in those with moderate UI, for 5.7 ± 1.8 points in those with severe UI and for 8.4 ± 2.6 in those with very severe UI (p < 0.001, paired samples t-test). Altogether, in 77 % patients diagnosed with SUI, a significant improvement was found after treatment, while only 34 % of women with MUI exhibited no UI at 1-year follow-up. Age did not affect the outcome. No major adverse effects were noticed in either group. The authors concluded that the findings of this study showed that new non-invasive Er:YAG laser could be regarded as a promising additional treatment strategy for SUI with at least 1 year lasting positive effects. On the other hand, it does not seem appropriate for treating MUI.

In a pilot study, Fistonic et al (2016) evaluated the safety and effectiveness of the Er:YAG laser for the treatment of SUI. The subject of this study is a treatment of SUI with a 2,940-nm Er:YAG laser, operating in a special SMOOTH mode designed to increase temperature of the vaginal mucosa up to maximally 60 to 65 °C without ablating the epidermis. Numerical modelling of the temperature distribution within mucosa tissue following an irradiation with the SMOOTH mode Er:YAG laser was performed in order to determine the appropriate range of laser parameters. The laser treatment parameters were further confirmed by measuring in-vivo temperatures of the vaginal mucosa using a thermal camera. To investigate the clinical safety and effectiveness of the
SMOOTH mode Er:YAG laser SUI treatment, a pilot clinical study was performed. The study recruited 31 female patients suffering from SUI; follow-ups were scheduled at 1, 2, and 6 months post-treatment. ICIQ-UI questionnaires were collected as a primary trial end-point. Secondary end-points included perineometry and residual urine volume measurements at baseline and all follow-ups. Thermal camera measurements have shown the optimal increase in temperature of the vaginal mucosa following treatment of SUI with a SMOOTH mode Er:YAG laser. Primary end-point, the change in ICIQ-UI score, showed clinically relevant and statistically significant improvement after all follow-ups compared to baseline scores. There was also improvement in the secondary end-points. Only mild and transient adverse events and no serious adverse events were reported. The authors concluded that the findings of this study indicated that non-ablative Er:YAG laser therapy is a promising minimally invasive non-surgical option for treating women with SUI symptoms. These preliminary findings need to be validated by well-designed studies.

**Benign Prostatic Hyperplasia:**

In a retrospective observational study, Palmero-Martí and colleagues (2017) compared the safety and effectiveness of thulium laser (Tm: YAG) 150W against greenlight laser (LBO:ND-YAG) 120W in the treatment of benign prostatic hyperplasia (BPH) 12 months after surgery. Subjects were men who underwent the surgical technique of prostate vaporization over a period of 4 years in the authors’ center. The homogeneity of the sample was checked, and
post-operative complications (acute urinary retention, re-entry, need for transfusion), failures per year of surgery (re-operation, peak flow less than 15ml/sec, no improvement in comparing the International Prostate Symptom Score (I-PSS)), and decreased prostate-specific antigen (PSA) were compared a year after surgery. A bivariate analysis using Chi-square and t-Student was carried out. A total of 116 patients were treated with thulium and 118 with green laser. The sample was homogeneous for pre-operative variables (p > 0.05). No differences in complications were observed: in urine acute retention, 4.3 % with thulium and 6.8 % with green laser (p = 0.41); in readmissions, 2.6 % with thulium and 1.7 % with green laser (p = 0.68); in need for transfusion, 2.6 % with thulium and 0 % with green laser (p = 0.12). No differences were observed in the percentage of patients re-operation (1.7 % in the group of thulium, 5.1 % in the green laser, p = 0.28); or in individuals with Qmax less than 15 ml/sec (6.9 % with thulium, 6.77 % with green laser, p = 0.75), or in the absence of improvement in the IPSS (5.2 % with thulium, 3.4 % with green laser, p = 0.65). There was also no difference in the levels of PSA in ng/ml a year after surgery: with thulium 2.78 ± 2.09 and with green laser 1.83 ± 1.48 (p = 0.75). The authors concluded that prostate vaporization with thulium laser 150W was comparable to that made with green laser 120W for the treatment of lower urinary tract symptoms caused by BPH, being both safe and effective techniques to 12 months after surgery. Moreover, they stated that future prospective randomized studies are needed to confirm this conclusion on both techniques.
Furthermore, an UpToDate review on “Transurethral procedures for treating benign prostatic hyperplasia” (Cunningham and Kadmon, 2017) states that “The Holmium:Yttrium-Aluminium-Garnet (YAG) (2,140 nm), Thulium:YAG (2,014 nm), and Neodymium:YAG (1,064 nm) lasers were initially developed to ablate tissue, but these lasers were less effective at ablating prostate tissue compared with the other lasers, since the wavelength of light used is near the peak of water absorption”.

Infantile Hemangioma:

Chinnadurai and associates (2016) reviewed studies of laser treatment of infantile hemangioma (IH). These investigators searched multiple databases including Medline and Embase from 1982 to June 2015. Two investigators independently screened studies against pre-determined criteria and extracted key data. Investigators independently assessed study risk of bias and the strength of the evidence of the body of literature. They identified 29 studies addressing lasers: 4 RCTs, 8 retrospective cohort studies, and 17 case series. Lasers varied across studies in type, pulse width, or cooling materials. Most comparative studies (n = 9) assessed variations of pulsed dye laser (PDL) and examined heterogeneous end-points. Most studies reported on treatment of cutaneous lesions. Overall, longer pulse PDL with epidermal cooling was the most commonly used laser for cutaneous lesions; Nd:YAG was the most commonly used intralesionally. Most studies reported a higher success rate with longer pulse PDL compared with observation in
managing the size of IH, although the magnitude of effect differed substantially. CO2 laser was used for subglottic IH in a single study, and was noted to have a higher success rate and lower complication rate than both Nd:YAG and observation. Studies comparing laser with β-blockers or in combination with β-blockers reported greater improvements in lesion size in combination arms versus β-blockers alone and greater effects of lasers on mixed superficial and deep IH. Strength of the evidence for outcomes after laser treatments ranged from insufficient to low for effectiveness outcomes. Strength of the evidence was insufficient for the effects of laser compared with β-blockers or in combination with β-blockers as studies evaluated different agents and laser types. Studies assessing outcomes after CO2 and Nd:YAG lasers typically reported some resolution of lesion size, but heterogeneity among studies limited their abilities to draw conclusions. The authors concluded that studies of laser treatment of IH primarily addressed different laser modalities compared with observation or other laser modalities. Pulsed dye laser was the most commonly studied laser type, but multiple variations in treatment protocols did not allow for demonstration of superiority of a single method. Most studies reported a higher success rate with longer pulse PDL compared to observation in managing the size of IH, although the magnitude of effect differed substantially. Studies generally found PDL more effective than other types of lasers for cutaneous lesions. When first introduced as a primary treatment for IH, various laser modalities generally offered superior outcomes compared with steroid therapy and observation. In the era of β-blocker
therapy, laser treatment may retain an important role in the treatment of residual and refractory lesions.

Furthermore, an UpToDate review on “Management of infantile hemangiomas” (Metry, 2017) states that “The pulsed-dye laser (PDL) cannot be expected to affect hemangiomas with deep involvement, since the depth of laser penetration is only 1.2 mm. The most accepted use of PDL in the management of hemangiomas is the treatment of ulceration, post-involution erythema, and/or telangiectasias. Which hemangiomas benefit most from laser therapy and what the optimal settings are remain areas of controversy”. This review does not mention YAG laser as a therapeutic option.

**Onychomycosis:**

Rivers and colleagues (2017) examined the effectiveness of a 1064-nm Nd:YAG laser for the treatment of onychomycosis in a real-world setting. A single-center retrospective chart review was conducted between 2012 and 2013. A total of 100 consecutive patients with a culture- and/or potassium hydroxide-confirmed diagnosis of onychomycosis were treated at least twice. Baseline and follow-up photographs were taken, and the change in degree of clinical nail involvement of the subject's great toenail was determined by a blinded reviewer using validated planimetry measurement. A total of 199 hallux nails from 100 subjects were assessed. The mean infected area decreased from 53.2 % at baseline to 50.8 % at the end of the study (paired t-test, p = 0.054; Wilcoxon signed rank test, p = 0.006). Degree of nail
involvement was statistically significantly associated with amount of improvement; subjects who had the greatest degree of nail involvement improved the most, while those with less severe disease showed a worsening of nail appearance (Kruskal-Wallis test, \( p < 0.001 \)); 72.6 % of nails that had more than 67 % nail involvement showed statistically significant improvement (\( \chi^2 \) test, \( p = 0.001 \)). Adverse events (AEs) were limited to mild-to-moderate pain at the time of therapy. A total of 76 subjects were assessed for treatment satisfaction: 60 % were very satisfied with treatment despite limited clinical improvement in some cases. The authors concluded that laser therapy has a very limited positive clinical effect on the appearance of onychomycosis after 2 treatment sessions.

Piccolo and associates (2017) evaluated the effectiveness of long-pulsed 1064-nm Nd:YAG laser in penetrating tissue and targeting the fungal overgrowth in the nail plate. A total of 20 consecutive, unselected patients were enrolled in the study and treated, at intervals of 1 week, for a total of 4 sessions, using a long-pulsed 1064-nm Nd:YAG laser. In each session, 3 passages across each nail plate were performed with 1-min pause between each passage. A special lens for dermatoscopy, connected to a digital camera, was used for dermoscopic images. In 14 patients (70 %; 12 females; 2 males), excellent results were obtained with an important reduction of chromonychia, onycholysis, opacity, longitudinal striae, and jagged proximal edge. Better results were observed in severe cases in the 2-month follow-up visit. The authors concluded that data for
treating nail onychomycosis with laser and light therapy appeared to be positive. They stated that the promising findings of this study identified long-pulsed 1064-nm Nd:YAG laser as a possible alternative option for the treatment of onychomycosis; however, increasing subject data, improving study methodology, and output parameters may become an important next step of study in the treatment of nail onychomycosis.

Furthermore, an UpToDate review on “Onychomycosis: Management” (Goldstein and Bhatia, 2017) states that “Although neodymium-doped:yttrium aluminum garnet (Nd:YAG) and diode lasers have emerged as treatment options for onychomycosis, data on the efficacy of these interventions are limited and the mechanisms of action and optimal regimens for these treatments remain unclear. Until more robust data supporting the efficacy of laser therapy for onychomycosis are available, we cannot recommend the routine use of this modality”.

**Port Wine Stain:**

Xing and colleagues (2017) stated that based on the principle of selective photothermolysis, 1064-nm Nd:YAG laser has great potential for the treatment of deeper and larger port wine stain (PWS). However, the clinical effectiveness is limited because of the weak absorption of blood to Nd:YAG laser. These researchers obtained the optimal irradiation conditions to effectively destroy vascular lesions with the assistance of PEG-modified gold nano-rods (NRs) to enhance blood absorption of Nd:YAG laser. In this study, PEG-modified gold NRs were prepared by the seeded growth method. Gold NRs after
exposure to Nd:YAG laser were characterized using absorption spectra and transmission electron microscope images. The tissue-like phantom containing a glass capillary with blood was prepared and exposed to Nd:YAG laser to investigate the laser energy density and pulse number required for blood coagulation before and after the addition of gold NRs in blood. The results showed that the milli-second Nd:YAG laser irradiation did not result in the shape change of gold NRs. After injection of gold NRs into the bloodstream (4.60 mg/kg), the absorbance of blood at 1064-nm increased 3.9 times. The threshold energy density for the treatment of PWS decreased by 33 % (from 30 to 20 J/cm²). The authors concluded that these findings provided an experimental guide for choosing laser parameters and gold NRs concentration for the treatment of deeper and larger PWS with the assistance of PEG-modified gold NRs in-vivo in the future.

Furthermore, and UpToDate review on “Laser and light therapy for cutaneous vascular lesions” (Kelly, 2017) states that “Millisecond pulsed near-infrared lasers such as the 755 nm alexandrite or 1064 neodymium:yttrium aluminum garnet (Nd:YAG) laser may be useful for the treatment of thick or nodular PWS. However, the risk of scarring with long wavelength lasers exceeds risk with PDL ....”.

Recurrent Aphthous Stomatitis:

Han and colleagues (2016) stated that laser therapy is a promising new treatment for patients with recurrent aphthous stomatitis (RAS). However, the clinical effect and security
issue of laser therapy remain controversial. These researchers performed a systematic review to evaluate the clinical effectiveness and security of laser treatment in RAS patients. Five electronic databases were searched (Medline (PubMed), Embase, ScienceDirect, the Cochrane Library, and Web of Science) to identify all studies that were about RCTs, involving the effect of laser therapy in RAS patients. A total of 23 studies were retained for full-text analysis after screening the titles and abstracts of potential articles, but only 10 studies satisfied the inclusion criteria after the full texts were reviewed. The included studies reported a comparison of the effectiveness between the laser treatment and placebo laser therapy (or conventional drug therapy) when managing the RAS patients. Clinical case reports and RCTs about several different types of lasers (e.g., Nd:YAG laser, Er:YAG laser, InGaAlP laser, GaAlAs laser, etc.) were reported in the use for treatment of RAS. The authors concluded that laser therapy has the superiority in relieving ulcer pain and shortening healing time when compared with placebo group or medical treatment group. They stated that the evidence of the retrieved studies is weak; thus, rigorously designed, long-term, randomized, controlled, and large sample-sized clinical trials are needed to confirm the effectiveness of laser on RAS therapy.

This study had several drawbacks: (i) although most of the included studies provided evidence that laser therapy may help in pain relief and promote wound healing, no report was conducted regarding the difference in recurrence rates after positive and placebo
treatments, (ii) most trials did not report their randomization process and whether treatment allocations were conducted. Nevertheless, treatment allocations may be recognized based on the materials and devices used, and (iii) cost analysis was not performed in this review because no study reported the price of laser therapy.

Furthermore, an UpToDate review on “Oral lesions” (Goldstein and Goldstein, 2017) does not mention laser as a therapeutic option for recurrent aphthous stomatitis.

Nd:YAG Laser for the Treatment of Basal Cell Carcinoma:

Jalian and colleagues (2014) stated that basal cell carcinomas (BCCs) have supporting vasculature that serves as a target for vascular selective lasers. These investigators determined the effect of repeated treatment with a combined 585-nm PDL and 1,064-nm Nd:YAG laser on BCCs of superficial and nodular subtypes of varying diameters. A total of 10 subjects with 13 biopsy-proven BCCs received 4 combined PDL and Nd:YAG at treatments 2 to 4 week intervals. None of the BCCs met the criteria for Mohs micrographic surgery. The tumor and 4 mm of peripheral skin were treated using standardized parameters delivered with a 7-mm spot with 10% overlap. The treated area was excised and evaluated histologically for residual tumor. The primary study end-point was histologic clearance of tumor. The secondary study end-point was blinded investigator assessment of clinical end-point and adverse effects. Approximately 50% of all tumors showed a complete response to 4 combined PDL and Nd:YAG treatments (n = 7/12,
58%). When stratified by size, 75% of all tumors less than 1 cm in diameter (n = 6/8) showed complete response. Tumor histologic types among the complete responders included superficial and nodular BCCs. All subjects with incompletely responding BCCs were on various forms of anti-coagulation, which these researchers hypothesized, may inhibit laser-mediated thrombosis necessary for the clinical effect. Blinded investigator assessment suggested that biopsy related erythema improved with subsequent laser treatments. The authors concluded that combined PDL and Nd:YAG laser was an effective means of reducing tumor burden in patients with BCC and may be a promising, emerging alternative therapy. They stated that factors influencing treatment response included the concomitant use of anti-coagulation; further studies with a larger number of subjects should focus on optimizing treatment parameters to increase treatment efficacy and aim to limit treatment sessions. Also, investigation into the role of anti-coagulation and its effect on the clinical efficacy of vascular lasers, for all clinical indications, is needed.

In a prospective, non-randomized, open-label, clinical trial, Ortiz and associates (2015) determined the safety, clinical, and histological efficacy of pulsed, high-fluence 1,064-nm Nd:YAG laser therapy for the treatment of BCC on the trunk and extremities. A total of 10 subjects with a biopsy-proven BCC less than 1.5 cm in diameter on the trunk or extremities received 1 treatment with a 10 milliseconds (ms) pulsed 1,064 nm Nd:YAG laser. Standard excision was performed 1 month after laser treatment to
confirm histologic clearance. The laser treatment was quick and well-tolerated. There was complete histologic clearance after 1 treatment in 92% of the BCC tumors, overall. At higher fluences, there was 100% histologic clearance after 1 treatment; no significant AEs were seen, including scarring. The authors concluded that 1,064-nm long-pulsed Nd:YAG laser may offer a safe alternative for treating BCC off the face. Moreover, they stated that a larger study is needed to confirm these preliminary results.

Ortiz and co-workers (2018) have previously conducted a pilot study that showed 100% histologic clearance at high fluences. Treatments were well-tolerated with no significant AEs. The objective of this larger study was to confirm preliminary results that the 1,064-nm Nd:YAG laser is a safe and effective method for treating non-facial BCC. This was an IRB-approved, prospective, multi-center study evaluating the safety and efficacy of the 1,064-nm Nd:YAG laser for the treatment of BCC on the trunk and extremities. A total of 33 subjects seeking treatment for biopsy-proven BCC that did not meet the criteria for Mohs surgery were recruited. Subjects on current anti-coagulation therapy, or with a history of immunosuppression were excluded. Subjects received 1 treatment with the 1,064-nm Nd:YAG laser as follows: 5 to 6 mm spot, fluence of 125 to 140 J/cm² and a pulse duration of 7 to 10 ms. Standard excision with 5 mm clinical margins was performed at 30 days after laser treatment to evaluate clinical and histologic clearance of BCC. Standardized photographs and adverse assessments were taken at the baseline visit, immediately after
laser treatment and on the day of excision. A total of 31 subjects completed the study; BCC tumors had a 90% (28 of 31 BCC tumors) histologic clearance rate after 1 treatment with the long-pulsed 1,064-nm Nd:YAG laser.

Treatments were generally well-tolerated without any anesthesia. Immediate side effects included edema and erythema. At 1-month follow-up, some patients had residual crusting; no significant AEs occurred. The authors concluded that 1,064-nm long-pulsed Nd:YAG laser is an alternative for treating non-facial BCC for those that were poor surgical candidates.

UpToDate reviews on “Treatment and prognosis of basal cell carcinoma at low risk of recurrence” (Aasi, 2018a) and “Treatment of basal cell carcinomas at high risk for recurrence” (Aasi, 2018b) do not mention laser as a therapeutic option.

Furthermore, National Comprehensive Cancer Network’s clinical practice guideline on “Basal cell skin cancer” (Version 1.2018) does not mention laser as a therapeutic option.

Nd:YAG Laser for the Treatment of Gastro-Intestinal tumors:

Saccomandi and colleagues (2017) noted that endoscopic submucosal dissection (ESD) is a minimally invasive technique allowing for the removal of early gastro-intestinal (GI) tumors, widely considered as a valid alternative to conventional surgery. However, ESD is technically demanding, and potentially severe complications, such as bleeding and perforation, may occur. Energy-based techniques (e.g.,
radiofrequency ablation) might offer a potential alternative to ESD. However, their use mandates the ability to predict the damage induced and to identify a "signature" of the complete ablation, without the need for a physical specimen.

Ideally, an energy-based procedure should be tunable in order to limit the ablation to the superficial layers, namely mucosa (M) and submucosa (SM), without injuring the muscularis propria (MP), thereby minimizing GI perforation. In this experimental study, these researchers examined thermal damage induced by Nd:YAG laser on the gastric wall, at different laser settings such as power (P) and time (t). Laser ablation was performed on the stomach wall of 6 Wistar rats. Two powers (2.5 W and 1.0 W) and 3 exposure times (12 s, 6 s and 2 s) were tested, for a total of 30 ablations. Histological analysis allowed to assess thermal damage, in terms of damage depth (DD) and identification of involved layers. The ratio (R) between DD and the total depth (TD) of target layers (M + SM) was used as an index to evaluate the effectiveness of laser settings. At P = 2.5 W, MP was damaged (R > 1) in the majority of cases (11/15). At P = 1.0 W, MP was preserved in all tests (R < ;1), and rarely (4/15) did the damage reach the whole SM (R = 1). Histopathological analysis evidenced that tissue damage was strongly related to the variable tissue thickness. The authors concluded that these preliminary results appeared to support the fact that endoscopic tunable laser ablation was feasible with a consistent damage/power correlation. They stated that further tests are needed to optimize the settings for applications on early GI tumors.

Nd:YAG Laser for the Treatment of Nail
Psoriasis:

Kartal and colleagues (2018) noted that psoriasis is a chronic inflammatory skin disease in which lesions display angiogenesis and increased vascularity. The long-pulsed 1,064-nm Nd:YAG laser treats vascular lesions which suggests that it might also be used to treat nail psoriasis. A total of 16 patients (10 males and 6 females) with isolated nail psoriasis or nail with only mild cutaneous involvement were enrolled in the study. Nails were treated for 3 sessions with long-pulsed 1,064-nm Nd:YAG laser once-monthly. During the course of the treatment, nail bed and matrix Nail Psoriasis Severity Index (NAPSI) scores were recorded. The mean baseline NAPSI score was 26 ± 7.2. The means of total NAPSI scores after the 1st, 2nd, and 3rd treatment sessions were as follows: 22 ± 6.6, 13 ± 6, and 5.7 ± 4.3, respectively. The decline in NAPSI score was statistically significant. At the end of the 3 treatment sessions, both nail bed and matrix lesions significantly responded to Nd:YAG laser treatment. The authors concluded that Nd:YAG laser is a promising therapeutic option for nail psoriasis.

Nd:YAG Laser for the Treatment of Pancreatic Cancer:

Di Matteo and colleagues (2018) stated that endoscopic ultrasound (EUS) has become an interventional technique in which a needle may be used as a vehicle to deliver therapeutic agents. Laser ablation (LA) has been used to treat many primary and secondary neoplasms. These researchers evaluated the feasibility of EUS-guided LA for unresectable pancreatic
cancer. Patients with a stage IIb to III pancreatic cancer underwent EUS-guided LA. All patients were unresponsive to previous chemo-radiotherapy. The laser ablation was performed by using a 300-μm flexible fiber preloaded on a 22-G fine needle. A 1064-nm wavelength Nd:YAG laser light with different power settings of 2 W for 800 J, 1,000 J and 1,200 J, 3 W for 800 J, 1,000 J and 1,200 J and 4 W for 800 J, 1,000 J and 1,200 J was used. Each patient was treated with a single application of one of these settings. The application time of the power settings ranged from 200 s to 600 s. A total of 9 patients (median age of 74.7 years, range of 55 to 85 years) underwent Nd:YAG LA. The mean size of the focal lesion was 35.4 mm (range of 21 to 45 mm). The ablation area demonstrated by 24 hours computed tomography (CT)-scan, ranged from 0.4 cm³ (for the lower power setting of 2 W/800 J) to a maximum of 6.4 cm³ (for 4 W/1000 J). The procedure was completed in all 9 patients without AEs. The authors concluded that EUS-guided LA was feasible and well-tolerated in patients with unresectable pancreatic cancer. These preliminary findings need to be validated by well-designed studies with larger sample size and long-term follow-ups.

Furthermore, National Comprehensive Cancer Network's clinical practice guideline on "Pancreatic adenocarcinoma" (Version 3.2017) does not mention laser as a therapeutic option.

Er:YAG Laser for the Treatment of Psoriasis:

Li and associates (2017) observed the promoting effects of the 2,940-nm Er:YAG fractional laser in topical drug delivery for psoriasis. A total of 5 (4
males and 1 female) recalcitrant psoriasis patients were given laser treatment 8 times at 1-week intervals with the following parameters: 5 to 11 % spot density and 100-µm energy depth. The psoriatic skin lesions on the left knee and the corresponding lesions at the right ones of each psoriasis patient were randomly divided into 2 groups: (i) laser + topical drug group (L); and (ii) drug alone group (D). The psoriatic lesions in both groups were treated with the same topical treatment (calcipotriol ointment). The corresponding psoriatic lesions in the L group received extra 2,940-nm Er:YAG laser irradiation before topical treatment. The photos of psoriatic lesions were taken before each treatment. The final photos were obtained from the patients at the 7th day after the final treatment. Drug alone or in combination with laser Er:YAG both reduced psoriatic lesions. However, with the increase in the number of treatments, increasing differences were observed between the treatment and the control sides. The therapeutic outcomes in the L groups were better than those in the D groups. Psoriasis area and severity index (PASI) scores for 5 cases of both groups were decreased. However, the scores in the L groups were lower than those in the D groups. The authors concluded that the use of 2,940-nm Er:YAG promoted the absorption of topical drugs for psoriasis, improving the therapeutic effect.

Ramez and co-workers (2018) noted that psoriasis is a commonly encountered chronic dermatological disease, presenting with inflammatory symptoms in patients. Systemic treatment of psoriasis is associated with several adverse effects, therefore the development of a
customized topical treatment modality for psoriasis would be an interesting alternative to systemic delivery. The therapeutic modality explored in this article was the comparative treatment of psoriatic patients using nano-particulated methotrexate in the form of jojoba oil-based micro-emulsion with or without fractional Er:YAG laser. Assessment parameters included follow-up photography for up to 8 weeks of treatment, estimation of the psoriasis severity [TES (thickness, erythema, scales)] score, and histopathological skin evaluation. The prepared methotrexate micro-emulsion was clinically beneficial and safe in treatment of psoriasis vulgaris. The authors concluded that the concomitant use of the fractional laser provided improvement in the psoriatic plaques within shorter time duration (3 weeks compared to 8 weeks of treatment), presenting an alternative topical treatment modality for psoriasis vulgaris.

CPT Codes / HCPCS Codes / ICD-10 Codes

Information in the [brackets] below has been added for clarification purposes. Codes requiring a 7th character are represented by "+":

<table>
<thead>
<tr>
<th>Code</th>
<th>Code Description</th>
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<tbody>
<tr>
<td>Nd:</td>
<td>YAG laser goniotomy:</td>
</tr>
<tr>
<td></td>
<td>CPT codes covered if selection criteria are met:</td>
</tr>
<tr>
<td>65820</td>
<td>Goniotomy [ND-YAG laser]</td>
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<tr>
<td></td>
<td>ICD-10 codes covered if selection criteria are met:</td>
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<tr>
<td>Q15.0</td>
<td>Congenital glaucoma [Primary congenital glaucoma]</td>
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<tr>
<td></td>
<td>Nd: YAG laser capsulotomy or hyaloidotomy:</td>
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<td></td>
<td>CPT codes covered if selection criteria are met:</td>
</tr>
<tr>
<td>Code</td>
<td>Code Description</td>
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<tr>
<td>----------</td>
<td>----------------------------------------------------------------------------------</td>
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<tr>
<td>66821</td>
<td>Discussion of secondary membranous cataract (opacified posterior lens capsule and/or anterior hyaloid); laser surgery (e.g., YAG laser) (one or more stages)</td>
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Other CPT codes related to the CPB:

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<tr>
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<tbody>
<tr>
<td>66830</td>
<td>Removal cataract</td>
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<tr>
<td>66984</td>
<td>Intravitreal injection of a pharmacologic agent (separate procedure)</td>
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Other HCPCS codes related to the CPB:

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<tbody>
<tr>
<td>J3301</td>
<td>Injection, triamcinolone acetonide, not otherwise specified</td>
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ICD-10 codes covered if selection criteria are met:

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<tr>
<th>Code</th>
<th>Code Description</th>
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<tbody>
<tr>
<td>H26.40</td>
<td>Secondary cataract</td>
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<td>H26.9</td>
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ICD-10 codes not covered for indications listed in the CPB:

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<th>Code</th>
<th>Code Description</th>
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<tr>
<td>H35.60</td>
<td>Retinal hemorrhage</td>
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<tr>
<td>H35.63</td>
<td></td>
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</tbody>
</table>

Nd: YAG laser vitreolysis:

CPT codes not covered for indications listed in the CPB:

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<thead>
<tr>
<th>Code</th>
<th>Code Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>67031</td>
<td>Severing of vitreous strands, vitreous face adhesions, sheets, membranes or opacities, laser surgery (1 or more stages)</td>
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ICD-10 codes not covered for indications listed in the CPB:

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<th>Code</th>
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<td>H43.391</td>
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<td>H43.399</td>
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<tr>
<td>H43.811</td>
<td>Vitreous degeneration</td>
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<td>H43.819</td>
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</table>

Nd: YAG laser peripheral iridotomy:

Other CPT codes not covered for indications listed in the CPB:
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<tr>
<th>Code</th>
<th>Code Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>66761</td>
<td>Iridotomy/iridectomy by laser surgery (eg, for glaucoma) (per session)</td>
</tr>
</tbody>
</table>

ICD-10 codes covered if selection criteria are met:

- **H40.061** - Primary angle closure without glaucoma damage
- **H40.069**
- **H40.20x+ - H40.249** - Primary angle-closure glaucoma

Nd: YAG laser goniopuncture [for rescue of failed trabeculectomy]:

CPT codes not covered for indications listed in the CPB:

- **66250** - Revision or repair of operative wound of anterior segment, any type, early or late, major or minor procedure

Other CPT codes related to the CPB:

- **65885** - Trabeculoplasty by laser surgery, 1 or more sessions (defined treatment series)

Nd: YAG laser for the treatment of chronic periodontitis, disc decompression, peri-implantitis, benign prostatic hyperplasia, infantile hemangioma, onychomycosis, port wine stain, and recurrent aphthous stomatitis - No specific code:

Other CPT codes related to the CPB:

- **0274T** - Percutaneous laminotomy/laminectomy (interlaminar approach) for decompression of neural elements, (with or without ligamentous resection, discectomy, facetectomy and/or foraminotomy), any method, under indirect image guidance (eg, fluoroscopic, CT), with or without the use of an endoscope, single or multiple levels, unilateral or bilateral; cervical or thoracic
<table>
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<th>Code</th>
<th>Code Description</th>
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<td>Percutaneous laminotomy/laminectomy (interlaminar approach) for decompression of neural elements, (with or without ligamentous resection, discectomy, facetectomy and/or foraminotomy), any method, under indirect image guidance (eg, fluoroscopic, CT), with or without the use of an endoscope, single or multiple levels, unilateral or bilateral; lumbar</td>
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<tr>
<td>17106 - 17108</td>
<td>Destruction of cutaneous vascular proliferative lesions (e.g., laser technique)</td>
</tr>
<tr>
<td>62287</td>
<td>Decompression procedure, percutaneous, of nucleus pulposus of intervertebral disk, any method, single or multiple levels, lumbar (eg, manual or automated percutaneous discectomy, percutaneous laser discetomy)</td>
</tr>
</tbody>
</table>

ICD-10 codes not covered for indications listed in the CPB:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B35.1</td>
<td>Tinea unguium</td>
</tr>
<tr>
<td>D18.00</td>
<td>Hemangioma unspecified site</td>
</tr>
<tr>
<td>K05.3 - K05.6</td>
<td>Chronic periodontitis</td>
</tr>
<tr>
<td>K12.0</td>
<td>Recurrent oral aphthae</td>
</tr>
<tr>
<td>M27.62</td>
<td>Post-osseointegration biological failure of dental implant</td>
</tr>
<tr>
<td>N40.0 - N40.3</td>
<td>Benign prostatic hyperplasia</td>
</tr>
<tr>
<td>Q82.5</td>
<td>Congenital non-neoplastic nevus</td>
</tr>
</tbody>
</table>

Er: YAG laser for the treatment of urinary incontinence and recurrent aphthous stomatitis - no specific code:

ICD-10 codes not covered for indications listed in the CPB:
<table>
<thead>
<tr>
<th>Code</th>
<th>Code Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>K12.0</td>
<td>Recurrent oral aphthae</td>
</tr>
<tr>
<td>N39.3</td>
<td>Stress incontinence (female) (male)</td>
</tr>
<tr>
<td>N39.4 - N39.498</td>
<td>Other specified urinary incontinence</td>
</tr>
<tr>
<td>R32</td>
<td>Unspecified urinary incontinence</td>
</tr>
</tbody>
</table>

The above policy is based on the following references:

16. Lundqvist B, Mönestam E. Ten-year longitudinal visual function and Nd: YAG...


53. Aasi SZ. Treatment and prognosis of basal cell carcinoma at low risk of recurrence. UpToDate Inc., Waltham, MA. Last reviewed January 2018a.

54. Aasi SZ. Treatment of basal cell carcinomas at high risk for recurrence. UpToDate Inc., Waltham, MA. Last reviewed January 2018b.


AETNA BETTER HEALTH® OF PENNSYLVANIA

Amendment to
Aetna Clinical Policy Bulletin Number:
0354 Yag Laser in Ophthalmology and Other Selected Indications

There are no amendments for Medicaid.

www.aetnabetterhealth.com/pennsylvania  revised 06/01/2018