MASSACHUSETTS

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Medical Policy

Dermatologic Applications of Photodynamic Therapy

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Policy Number: 463

BCBSA Reference Number: 2.01.44 (For Plans internal use only)

Related Policies

- Light Therapy for Psoriasis, #698
- Oncologic Applications of Photodynamic Therapy, Including Barrett's Esophagus, #454
- Photodynamic Therapy for Choroidal Neovascularization, #599

Policy

Commercial Members: Managed Care (HMO and POS), PPO, and Indemnity

Photodynamic therapy may be considered **MEDICALLY NECESSARY** as a treatment of:

- Nonhyperkeratotic actinic keratoses of the face and scalp.
- Nonhyperkeratotic actinic keratoses of the upper extremities.
- Low-risk (eg superficial and nodular) basal cell skin cancer only when surgery and radiation are contraindicated.
- Cutaneous squamous cell carcinoma in situ (Bowen disease) only when surgery and radiation are contraindicated.

Photodynamic therapy is considered **INVESTIGATIONAL** for other dermatologic applications, including, but not limited to, acne vulgaris, high-risk basal cell carcinomas, hidradenitis suppurativa and mycoses.

Photodynamic therapy as a technique of skin rejuvenation, hair removal, or other cosmetic indications is considered **NOT MEDICALLY NECESSARY**.

Prior Authorization Information

Inpatient

- For services described in this policy, precertification/preauthorization **IS REQUIRED** if the procedure is performed **inpatient**.

Outpatient

- For services described in this policy, see below for situations where prior authorization **might be required** if the procedure is performed **outpatient**.

	Outpatient
Commercial Managed Care (HMO and POS)	Prior authorization is **not required**.
Commercial PPO and Indemnity	Prior authorization is **not required**.

CPT Codes / HCPCS Codes / ICD Codes

Inclusion or exclusion of a code does not constitute or imply member coverage or provider reimbursement. Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage as it applies to an individual member.

Providers should report all services using the most up-to-date industry-standard procedure, revenue, and diagnosis codes, including modifiers where applicable.

The following codes are included below for informational purposes only; this is not an all-inclusive list.

The above medical necessity criteria MUST be met for the following codes to be covered for Commercial Members: Managed Care (HMO and POS), PPO, Indemnity, Medicare HMO Blue and Medicare PPO Blue:

CPT Codes

CPT codes:	Code Description
96567	Photodynamic therapy by external application of light to destroy premalignant lesions of the skin and adjacent mucosa with application and illumination/activation of photosensitive drug(s), per day
96573	Photodynamic therapy by external application of light to destroy premalignant lesions of the skin and adjacent mucosa with application and illumination/activation of photosensitizing drug(s) provided by a physician or other qualified health care professional, per day
96574	Debridement of premalignant hyperkeratotic lesion(s) (ie, targeted curettage, abrasion) followed with photodynamic therapy by external application of light to destroy premalignant lesions of the skin and adjacent mucosa with application and illumination/activation of photosensitizing drug(s) provided by a physician or other qualified health care professional, per day

HCPCS Codes

HCPCS codes:	Code Description
J7308	Aminolevulinic hydrochloric acid for topical administration, 20%, single unit dosage form (354 mg)
J7309	Methyl aminolevulinate (MAL) for topical administration, 16.8%, 1 gram
J7345	Aminolevulinic acid HCl for topical administration, 10% gel, 10 mg

The following ICD Diagnosis Codes are considered medically necessary when submitted with the CPT and HCPCS codes above if medical necessity criteria are met:

ICD- 10 Diagnosis Codes

ICD-10-CM Diagnosis codes:	Code Description
C44.01	Basal Cell Carcinoma of Skin Of Lip
C44.111	Basal Cell Carcinoma of Skin Of Unspecified Eyelid, Including Canthus
C44.112	Basal Cell Carcinoma of Skin of Right Eyelid, Including Canthus

C44.119	Basal Cell Carcinoma of Skin of Left Eyelid, Including Canthus
C44.211	Basal Cell Carcinoma of Skin of Unspecified Ear and External Auricular Canal
C44.212	Basal Cell Carcinoma of Skin of Right Ear and External Auricular Canal
C44.219	Basal Cell Carcinoma of Skin of Left Ear and External Auricular Canal
C44.310	Basal Cell Carcinoma of Skin of Unspecified Parts of Face
C44.311	Basal Cell Carcinoma of Skin of Nose
C44.319	Basal Cell Carcinoma of Skin of Other Parts of Face
C44.41	Basal Cell Carcinoma of Skin of Scalp and Neck
C44.510	Basal Cell Carcinoma of Anal Skin
C44.511	Basal Cell Carcinoma of Skin of Breast
C44.519	Basal Cell Carcinoma of Skin of Other Part of Trunk
C44.611	Basal Cell Carcinoma of Skin of Unspecified Upper Limb, Including Shoulder
C44.612	Basal Cell Carcinoma of Skin of Right Upper Limb, Including Shoulder
C44.619	Basal Cell Carcinoma of Skin of Left Upper Limb, Including Shoulder
C44.711	Basal Cell Carcinoma of Skin of Unspecified Lower Limb, Including Hip
C44.712	Basal Cell Carcinoma of Skin of Right Lower Limb, Including Hip
C44.719	Basal Cell Carcinoma of Skin of Left Lower Limb, Including Hip
C44.81	Basal Cell Carcinoma of Overlapping Sites of Skin
C44.91	Basal Cell Carcinoma of Skin, Unspecified
D04.0	Carcinoma In Situ of Skin of Lip
D04.10	Carcinoma In Situ of Skin of Unspecified Eyelid, Including Canthus
D04.111	Carcinoma in situ of skin of right upper eyelid, including canthus
D04.112	Carcinoma in situ of skin of right lower eyelid, including canthus
D04.121	Carcinoma in situ of skin of left upper eyelid, including canthus
D04.122	Carcinoma in situ of skin of left lower eyelid, including canthus
D04.20	Carcinoma In Situ of Skin of Unspecified Ear and External Auricular Canal
D04.21	Carcinoma In Situ of Skin of Right Ear and External Auricular Canal
D04.22	Carcinoma In Situ of Skin of Left Ear and External Auricular Canal
D04.30	Carcinoma In Situ of Skin of Unspecified Part of Face
D04.39	Carcinoma In Situ of Skin of Other Parts of Face
D04.4	Carcinoma In Situ of Skin of Scalp and Neck
D04.5	Carcinoma In Situ of Skin of Trunk
D04.60	Carcinoma In Situ of Skin of Unspecified Upper Limb, Including Shoulder
D04.61	Carcinoma In Situ of Skin of Right Upper Limb, Including Shoulder
D04.62	Carcinoma In Situ of Skin of Left Upper Limb, Including Shoulder
D04.70	Carcinoma In Situ of Skin of Unspecified Lower Limb, Including Hip
D04.71	Carcinoma In Situ of Skin of Right Lower Limb, Including Hip
D04.72	Carcinoma In Situ of Skin of Left Lower Limb, Including Hip
D04.8	Carcinoma In Situ of Skin of Other Sites
D04.9	Carcinoma In Situ of Skin, Unspecified
L57.0	Actinic Keratosis

Description

Photodynamic therapy (PDT) refers to light activation of a photosensitizer to generate highly reactive intermediaries, which ultimately cause tissue injury and necrosis. Two common photosensitizing agents are 5-aminolevulinic acid (ALA) and its methyl ester, methyl aminolevulinate. When applied topically, these agents pass readily through abnormal keratin overlying the lesion and accumulate preferentially in dysplastic cells. The agents ALA and methyl aminolevulinate are metabolized by underlying cells to photosensitizing concentrations of porphyrins. Subsequent exposure to photoactivation (maximum absorption at 404 to 420 nm and 635 nm) generates reactive oxygen species that are cytotoxic, ultimately destroying the lesion. PDT can cause erythema, burning, and pain. Healing occurs within 10 to 14 days,

with generally acceptable cosmetic results. PDT with topical ALA has been investigated primarily as a treatment of actinic keratoses (AKs).

Summary

Photodynamic therapy (PDT) refers to light activation of a photosensitizer to generate highly reactive intermediaries, which ultimately cause tissue injury and necrosis. Photosensitizing agents are being proposed for use with dermatologic conditions such as actinic keratoses (AKs) and nonmelanoma skin cancers.

Summary of Evidence

For individuals who have nonhyperkeratotic AKs on the face or scalp who receive PDT, the evidence includes meta-analyses and randomized controlled trials (RCTs). Relevant outcomes are symptoms, change in disease status, quality of life (QOL), and treatment-related morbidity. Evidence from multiple RCTs has found that PDT improves the net health outcome as measured by complete clinical clearance of lesions in patients with nonhyperkeratotic AKs on the face or scalp compared with placebo or other active interventions. The evidence is sufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have nonhyperkeratotic AKs on the upper extremities who receive PDT, the evidence includes a systematic review and RCTs. Relevant outcomes are symptoms, change in disease status, QOL, and treatment-related morbidity. A systematic review of interventions for nonface and nonscalp AKs found PDT to be superior to placebo for complete clearance but found a significant increase in complete clearance with cryotherapy versus PDT. In 2 placebo-controlled RCTs, significantly more patients had a complete clearance of AKs with ALA/PDT with blue light compared to placebo at 12 weeks, and a third found a significantly greater reduction in mean lesion count at 4 weeks. Two small RCTs compared ALA/PDT using red light to imiquimod or 5-fluorouracil and found similar efficacy between the active treatment groups after 6 months of follow-up. The evidence is sufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have low-risk basal cell carcinoma who receive PDT, the evidence includes RCTs and systematic reviews of RCTs. Relevant outcomes are symptoms, change in disease status, QOL, and treatment-related morbidity. Systematic reviews of RCTs have found that PDT may not be as effective as surgery for low-risk superficial and nodular basal cell carcinoma. In the small number of trials available, PDT was more effective than a placebo. The available evidence from RCTs has suggested that PDT has better cosmetic outcomes than surgery for low-risk basal cell carcinoma. The evidence is sufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have squamous cell carcinoma in situ who receive PDT, the evidence includes a meta-analysis and RCTs. The relevant outcomes are symptoms, change in disease status, QOL, and treatment-related morbidity. RCTs have found that PDT has similar or greater efficacy compared with cryotherapy and 5-fluorouracil. Additionally, adverse events and cosmetic outcomes appear to be better after PDT. Few RCTs have compared PDT with surgery or radiotherapy; as a result, conclusions cannot be drawn about PDT compared with these other standard treatments. Current guidance from the National Comprehensive Cancer Network notes that topical modalities, including PDT, may have lower cure rates than with surgical treatment. The evidence is sufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have nonmetastatic invasive squamous cell carcinoma who receive PDT, the evidence includes observational studies and a systematic review of observational studies.
The relevant outcomes are overall survival, symptoms, change in disease status, QOL, and treatment-related morbidity. Conclusions cannot be drawn from small, uncontrolled studies. RCTs are needed to determine the safety and efficacy of PDT for this condition. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.
For individuals who have acne who receive PDT, the evidence includes RCTs and systematic reviews. Relevant outcomes are symptoms, change in disease status, QOL, and treatment-related morbidity. The available RCTs have not consistently found significantly better outcomes with PDT compared with other

interventions, and meta-analyses s did not find significantly better results with PDT versus placebo. Several trials have found that PDT is associated with high rates of adverse events leading to the cessation of treatment. Trials tended to have relatively small sample sizes and used a variety of comparison interventions. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have noncancerous dermatologic skin conditions (eg, hidradenitis suppurativa, mycoses, port-wine stain) who receive PDT, the evidence includes case series, systematic reviews of uncontrolled series, and an RCT for port-wine stain. Relevant outcomes are symptoms, change in disease status, QOL, and treatment-related morbidity. RCTs are needed to determine the safety and efficacy of PDT for these conditions. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

Policy History

Date	Action
2/2022	Annual policy review. Description, summary, and references updated. Policy statements unchanged.
2/2021	Annual policy review. Description, summary, and references updated. Policy statements unchanged.
1/2021	Medicare information removed. See MP #132 Medicare Advantage Management for local coverage determination and national coverage determination reference.
5/2020	Annual policy review. Added new indication and medically necessary statement for nonhyperkeratotic actinic keratoses of the upper extremities. Effective 5/1/2020.
2/2019	Annual policy review. Description, summary, and references updated. Policy statements unchanged.
10/2018	Clarified coding information.
5/2018	Clarified coding information.
3/2018	Annual policy review. New references added.
1/2018	Clarified coding information.
1/2017	Annual policy review. New references added.
3/2016	Annual policy review. New references added.
6/2015	Annual policy review. Superficial basal cell carcinoma changed to low-risk (ie superficial or nodular) basal cell carcinoma. Non-superficial basal cell carcinoma changed to high-risk basal cell carcinoma. Dermatologic Applications of Photodynamic Therapy transferred from policy #068, Plastic Surgery. Effective 6/1/2015.

Information Pertaining to All Blue Cross Blue Shield Medical Policies

Click on any of the following terms to access the relevant information:
Medical Policy Terms of Use
Managed Care Guidelines
Indemnity/PPO Guidelines
Clinical Exception Process
Medical Technology Assessment Guidelines

References

1. Reynolds KA, Schlessinger DI, Vasic J, et al. Core Outcome Set for Actinic Keratosis Clinical Trials. JAMA Dermatol. Mar 01 2020; 156(3): 326-333. PMID 31939999
2. Patel G, Armstrong AW, Eisen DB. Efficacy of photodynamic therapy vs other interventions in randomized clinical trials for the treatment of actinic keratoses: a systematic review and meta-analysis. JAMA Dermatol. Dec 2014; 150(12): 1281-8. PMID 25162181

3. Ezzedine K, Painchault C, Brignone M. Systematic Literature Review and Network Meta-analysis of the Efficacy and Acceptability of Interventions in Actinic Keratoses. Acta Derm Venereol. Jan 04 2021; 101(1): adv00358. PMID 33170301
4. Steeb T, Wessely A, Schmitz L, et al. Interventions for Actinic Keratosis in Nonscalp and Nonface Localizations: Results from a Systematic Review with Network Meta-Analysis. J Invest Dermatol. Feb 2021; 141(2): 345-354.e8. PMID 32645365
5. Pariser DM, Lowe NJ, Stewart DM, et al. Photodynamic therapy with topical methyl aminolevulinate for actinic keratosis: results of a prospective randomized multicenter trial. J Am Acad Dermatol. Feb 2003; 48(2): 227-32. PMID 12582393
6. Morton C, Campbell S, Gupta G, et al. Intraindividual, right-left comparison of topical methyl aminolaevulinate-photodynamic therapy and cryotherapy in subjects with actinic keratoses: a multicentre, randomized controlled study. Br J Dermatol. Nov 2006; 155(5): 1029-36. PMID 17034536
7. Hauschild A, Stockfleth E, Popp G, et al. Optimization of photodynamic therapy with a novel self-adhesive 5-aminolaevulinic acid patch: results of two randomized controlled phase III studies. Br J Dermatol. May 2009; 160(5): 1066-74. PMID 19222455
8. Szeimies RM, Radny P, Sebastian M, et al. Photodynamic therapy with BF-200 ALA for the treatment of actinic keratosis: results of a prospective, randomized, double-blind, placebo-controlled phase III study. Br J Dermatol. Aug 2010; 163(2): 386-94. PMID 20518784
9. Szeimies RM, Stockfleth E, Popp G, et al. Long-term follow-up of photodynamic therapy with a self-adhesive 5-aminolaevulinic acid patch: 12 months data. Br J Dermatol. Feb 01 2010; 162(2): 410-4. PMID 19804593
10. Serra-Guillen C, Nagore E, Hueso L, et al. A randomized pilot comparative study of topical methyl aminolevulinate photodynamic therapy versus imiquimod 5% versus sequential application of both therapies in immunocompetent patients with actinic keratosis: clinical and histologic outcomes. J Am Acad Dermatol. Apr 2012; 66(4): e131-7. PMID 22226430
11. Dirschka T, Radny P, Dominicus R, et al. Photodynamic therapy with BF-200 ALA for the treatment of actinic keratosis: results of a multicentre, randomized, observer-blind phase III study in comparison with a registered methyl-5-aminolaevulinate cream and placebo. Br J Dermatol. Jan 2012; 166(1): 137-46. PMID 21910711
12. Dirschka T, Radny P, Dominicus R, et al. Long-term (6 and 12 months) follow-up of two prospective, randomized, controlled phase III trials of photodynamic therapy with BF-200 ALA and methyl aminolaevulinate for the treatment of actinic keratosis. Br J Dermatol. Apr 2013; 168(4): 825-36. PMID 23252768
13. Zane C, Facchinetti E, Rossi MT, et al. A randomized clinical trial of photodynamic therapy with methyl aminolaevulinate vs. diclofenac 3% plus hyaluronic acid gel for the treatment of multiple actinic keratoses of the face and scalp. Br J Dermatol. May 2014; 170(5): 1143-50. PMID 24506666
14. Reinhold U, Dirschka T, Ostendorf R, et al. A randomized, double-blind, phase III, multicentre study to evaluate the safety and efficacy of BF-200 ALA (Ameluz((R))) vs. placebo in the field-directed treatment of mild-to-moderate actinic keratosis with photodynamic therapy (PDT) when using the BF-RhodoLED((R)) lamp. Br J Dermatol. Oct 2016; 175(4): 696-705. PMID 26921093
15. Karrer S, Szeimies RM, Philipp-Dormston WG, et al. Repetitive Daylight Photodynamic Therapy versus Cryosurgery for Prevention of Actinic Keratoses in Photodamaged Facial Skin: A Prospective, Randomized Controlled Multicentre Two-armed Study. Acta Derm Venereol. Jan 04 2021; 101(1): adv00355. PMID 33313936
16. Cortelazzi C, Odorici G, Castagnetti E, et al. Comparative study of imiquimod 3.75% vs. photodynamic therapy for actinic keratosis of the scalp. Photodermatol Photoimmunol Photomed. Sep 2021; 37(5): 404-409. PMID 33566432
17. Brian Jiang SI, Kempers S, Rich P, et al. A Randomized, Vehicle-Controlled Phase 3 Study of Aminolevulinic Acid Photodynamic Therapy for the Treatment of Actinic Keratoses on the Upper Extremities. Dermatol Surg. Jul 2019; 45(7): 890-897. PMID 30640777
18. Schmieder GJ, Huang EY, Jarratt M. A multicenter, randomized, vehicle-controlled phase 2 study of blue light photodynamic therapy with aminolevulinic acid HCl 20% topical solution for the treatment of actinic keratoses on the upper extremities: the effect of occlusion during the drug incubation period. J Drugs Dermatol. Dec 2012; 11(12): 1483-9. PMID 23377520

19. Taub AF, Garretson CB. A randomized, blinded, bilateral intraindividual, vehicle-controlled trial of the use of photodynamic therapy with 5-aminolevulinic acid and blue light for the treatment of actinic keratoses of the upper extremities. J Drugs Dermatol. Sep 2011; 10(9): 1049-56. PMID 22052276
20. Sotiriou E, Apalla Z, Maliamani F, et al. Intraindividual, right-left comparison of topical 5-aminolevulinic acid photodynamic therapy vs. 5% imiquimod cream for actinic keratoses on the upper extremities. J Eur Acad Dermatol Venereol. Sep 2009; 23(9): 1061-5. PMID 19470041
21. Kurwa HA, Yong-Gee SA, Seed PT, et al. A randomized paired comparison of photodynamic therapy and topical 5-fluorouracil in the treatment of actinic keratoses. J Am Acad Dermatol. Sep 1999; 41(3 Pt 1): 414-8. PMID 10459115
22. Wang H, Xu Y, Shi J, et al. Photodynamic therapy in the treatment of basal cell carcinoma: a systematic review and meta-analysis. Photodermatol Photoimmunol Photomed. Jan 2015; 31(1): 44-53. PMID 25377432
23. Mpourazanis G, Mpourazanis P, Stogiannidis G, et al. The effectiveness of photodynamic therapy and cryotherapy on patients with basal cell carcinoma: A systematic review and meta-analysis. Dermatol Ther. Nov 2020; 33(6): e13881. PMID 32558087
24. Zou Y, Zhao Y, Yu J, et al. Photodynamic therapy versus surgical excision to basal cell carcinoma: meta-analysis. J Cosmet Dermatol. Dec 2016; 15(4): 374-382. PMID 27363535
25. Bath-Hextall FJ, Perkins W, Bong J, et al. Interventions for basal cell carcinoma of the skin. Cochrane Database Syst Rev. Jan 24 2007; (1): CD003412. PMID 17253489
26. Roozeboom MH, Arits AHMM, Mosterd K, et al. Three-Year Follow-Up Results of Photodynamic Therapy vs. Imiquimod vs. Fluorouracil for Treatment of Superficial Basal Cell Carcinoma: A Single-Blind, Noninferiority, Randomized Controlled Trial. J Invest Dermatol. Aug 2016; 136(8): 1568-1574. PMID 27113429
27. Szeimies RM, Ibbotson S, Murrell DF, et al. A clinical study comparing methyl aminolevulinate photodynamic therapy and surgery in small superficial basal cell carcinoma (8-20 mm), with a 12-month follow-up. J Eur Acad Dermatol Venereol. Nov 2008; 22(11): 1302-11. PMID 18624836
28. Rhodes LE, de Rie M, Enstrom Y, et al. Photodynamic therapy using topical methyl aminolevulinate vs surgery for nodular basal cell carcinoma: results of a multicenter randomized prospective trial. Arch Dermatol. Jan 2004; 140(1): 17-23. PMID 14732655
29. Rhodes LE, de Rie MA, Leifsdottir R, et al. Five-year follow-up of a randomized, prospective trial of topical methyl aminolevulinate photodynamic therapy vs surgery for nodular basal cell carcinoma. Arch Dermatol. Sep 2007; 143(9): 1131-6. PMID 17875873
30. Bath-Hextall FJ, Matin RN, Wilkinson D, et al. Interventions for cutaneous Bowen's disease. Cochrane Database Syst Rev. Jun 24 2013; (6): CD007281. PMID 23794286
31. Zhong S, Zhang R, Mei X, et al. Efficacy of photodynamic therapy for the treatment of Bowen's disease: An updated systematic review and meta-analysis of randomized controlled trials. Photodiagnosis Photodyn Ther. Dec 2020; 32: 102037. PMID 33011394
32. Morton C, Horn M, Leman J, et al. Comparison of topical methyl aminolevulinate photodynamic therapy with cryotherapy or Fluorouracil for treatment of squamous cell carcinoma in situ: Results of a multicenter randomized trial. Arch Dermatol. Jun 2006; 142(6): 729-35. PMID 16785375
33. Salim A, Leman JA, McColl JH, et al. Randomized comparison of photodynamic therapy with topical 5-fluorouracil in Bowen's disease. Br J Dermatol. Mar 2003; 148(3): 539-43. PMID 12653747
34. Lansbury L, Bath-Hextall F, Perkins W, et al. Interventions for non-metastatic squamous cell carcinoma of the skin: systematic review and pooled analysis of observational studies. BMJ. Nov 04 2013; 347: f6153. PMID 24191270
35. Barbaric J, Abbott R, Posadzki P, et al. Light therapies for acne. Cochrane Database Syst Rev. Sep 27 2016; 9: CD007917. PMID 27670126
36. Wu Y, Deng Y, Huang P. Application of red light therapy for moderate-to-severe acne vulgaris: A systematic review and meta-analysis. J Cosmet Dermatol. Nov 2021; 20(11): 3498-3508. PMID 34363730
37. Wojewoda K, Gillstedt M, Tovi J, et al. Optimizing treatment of acne with photodynamic therapy (PDT) to achieve long-term remission and reduce side effects. A prospective randomized controlled trial. J Photochem Photobiol B. Oct 2021; 223: 112299. PMID 34500216
38. Nicklas C, Rubio R, Cardenas C, et al. Comparison of efficacy of aminolaevulinic acid photodynamic therapy vs. adapalene gel plus oral doxycycline for treatment of moderate acne vulgaris-A simple,

blind, randomized, and controlled trial. Photodermatol Photoimmunol Photomed. Jan 2019; 35(1): 3-10. PMID 29993146
39. Xu X, Zheng Y, Zhao Z, et al. Efficacy of photodynamic therapy combined with minocycline for treatment of moderate to severe facial acne vulgaris and influence on quality of life. Medicine (Baltimore). Dec 2017; 96(51): e9366. PMID 29390528
40. Pariser DM, Eichenfield LF, Bukhalo M, et al. Photodynamic therapy with methyl aminolaevulinate 80 mg g(-1) for severe facial acne vulgaris: a randomized vehicle-controlled study. Br J Dermatol. Apr 2016; 174(4): 770-7. PMID 26663215
41. Orringer JS, Sachs DL, Bailey E, et al. Photodynamic therapy for acne vulgaris: a randomized, controlled, split-face clinical trial of topical aminolevulinic acid and pulsed dye laser therapy. J Cosmet Dermatol. Mar 2010; 9(1): 28-34. PMID 20367670
42. Wiegell SR, Wulf HC. Photodynamic therapy of acne vulgaris using methyl aminolaevulinate: a blinded, randomized, controlled trial. Br J Dermatol. May 2006; 154(5): 969-76. PMID 16634903
43. Shen JJ, Jemec GBE, Arendrup MC, et al. Photodynamic therapy treatment of superficial fungal infections: A systematic review. Photodiagnosis Photodyn Ther. Sep 2020; 31: 101774. PMID 32339671
44. Wu Q, Tu P, Zhou G, et al. A dose-finding study for hemoporfin in photodynamic therapy for port-wine stain: A multicenter randomized double-blind phase IIb trial. Photodermatol Photoimmunol Photomed. Sep 2018; 34(5): 314-321. PMID 29533491
45. Gold M, Bridges TM, Bradshaw VL, et al. ALA-PDT and blue light therapy for hidradenitis suppurativa. J Drugs Dermatol. Jan-Feb 2004; 3(1 Suppl): S32-5. PMID 14964759
46. Schweiger ES, Riddle CC, Aires DJ. Treatment of hidradenitis suppurativa by photodynamic therapy with aminolevulinic acid: preliminary results. J Drugs Dermatol. Apr 2011; 10(4): 381-6. PMID 21455548
47. Calzavara-Pinton PG, Venturini M, Capezzera R, et al. Photodynamic therapy of interdigital mycoses of the feet with topical application of 5-aminolevulinic acid. Photodermatol Photoimmunol Photomed. Jun 2004; 20(3): 144-7. PMID 15144392
48. Mostafa D, Tarakji B. Photodynamic therapy in treatment of oral lichen planus. J Clin Med Res. Jun 2015; 7(6): 393-9. PMID 25883701
49. Yazdani Abyaneh MA, Falto-Aizpurua L, Griffith RD, et al. Photodynamic therapy for actinic cheilitis: a systematic review. Dermatol Surg. Feb 2015; 41(2): 189-98. PMID 25627629
50. Xiao Q, Li Q, Yuan KH, et al. Photodynamic therapy of port-wine stains: long-term efficacy and complication in Chinese patients. J Dermatol. Dec 2011; 38(12): 1146-52. PMID 22032688
51. Chun-Hua T, Li-Qiang G, Hua W, et al. Efficacy and safety of hemoporfin photodynamic therapy for port-wine stains in paediatric patients: A retrospective study of 439 cases at a single centre. Photodiagnosis Photodyn Ther. Dec 2021; 36: 102568. PMID 34614424
52. Zhang LC, Yang J, Huang YB, et al. Efficacy of hemoporfin photodynamic therapy for pulsed dye laser-resistant facial port-wine stains in 107 children: A retrospective study. Indian J Dermatol Venereol Leprol. Oct 15 2021: 1-6. PMID 34672476
53. Eisen DB, Asgari MM, Bennett DD, et al. Guidelines of care for the management of actinic keratosis. J Am Acad Dermatol. Oct 2021; 85(4): e209-e233. PMID 33820677
54. Kim JYS, Kozlow JH, Mittal B, et al. Guidelines of care for the management of basal cell carcinoma. J Am Acad Dermatol. Mar 2018; 78(3): 540-559. PMID 29331385
55. Zaenglein AL, Pathy AL, Schlosser BJ, et al. Guidelines of care for the management of acne vulgaris. J Am Acad Dermatol. May 2016; 74(5): 945-73.e33. PMID 26897386
56. National Comprehensive Cancer Network (NCCN), NCCN Clinical Practice Guidelines in Oncology: Squamous Cell Skin Cancer. Version 2.2021. https://www.nccn.org/professionals/physician_gls/pdf/squamous.pdf. Accessed October 22, 2021.
57. National Comprehensive Cancer Network (NCCN). NCCN Practice Guidelines in Oncology: Basal cell skin cancer. Version 2.2021. https://www.nccn.org/professionals/physician_gls/pdf/nmsc.pdf. Accessed October 23, 2021.
58. Centers for Medicare and Medicaid Services. National Coverage Determination (NCD) for Treatment of Actinic Keratosis (250.4). 2011; https://www.cms.gov/medicare-coverage-database/details/ncd-details.aspx?NCDId=129&ncdver=1&bc=AAAAIAAAAAAA&. Accessed October 22, 2021.