SKIN

# Clinical Management Recommendations

## The Role of Image-Guided Superficial Radiation Therapy in the Treatment of Nonmelanoma Skin Cancer

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## ABSTRACT

**Background**: Basal cell carcinoma (BCC) and squamous cell carcinoma, collectively referred to as nonmelanoma skin cancer (NMSC) are the most common type of skin cancer and can lead to significant morbidity and mortality. There are several treatment options available for NMSC including superficial radiation therapy (SRT), which has improved in recent years with the addition of image guidance (IGSRT). In some cases, patients are not offered IGSRT as a treatment option and additional guidance on its benefits may be beneficial.
**Objective**: For a panel of expert dermatologists to review published studies on IGSRT for the treatment NMSC and create consensus recommendations on its use.
**Methods**: A comprehensive literature search of PubMed, EMBASE, Scopus, and Google Scholar was completed for English-language original research articles on the use of IGSRT to treat NMSC. A panel of six dermatologists with significant expertise in treating NMSC convened to review the articles and create consensus statements based on the available data. A modified Delphi process was used to approve each statement for adoption and a strength of recommendation was assigned using Strength of Recommendation Taxonomy (SORT) criteria.
**Results**: After screening the articles that met the initial search criteria, 12 articles were distributed to the panelists for review prior to the roundtable discussion. The panel unanimously voted to adopt eight statements with an additional two statements receiving five out of six votes for adoption. Eight of the statements received a strength of recommendation of “A” while two of the statements were given a strength of recommendation of “B” based on SORT criteria.
**Conclusion**: IGSRT is a safe and effective treatment for NMSC that often results in highly favorable cosmetic outcomes. It can be considered a first-line treatment option for appropriately selected cases of NMSC.

## INTRODUCTION

Cutaneous squamous cell carcinoma (cSCC) and basal cell carcinoma (BCC), often collectively referred to as nonmelanoma skin cancer (NMSC), are the two most common types of skin cancer, with approximately 5.4 million cases combined each year in the United States (US) alone.[1-3] While each of these malignancies typically has a high cure rate, there can still be significant morbidity and mortality associated with them in many cases.[4,5] In fact, in 2012 the number of deaths in the US attributable to cSCC was estimated to be between 3,932 and 8,971, and this number now likely exceeds the number of annual deaths from melanoma.[6,7] While BCCs rarely metastasize and their associated mortality is very low, they most often involve the head and neck area and can cause marked local tissue destruction if left untreated.[5] The management of NMSC can include surgical excision, electrodessication and curettage, radiation therapy, photodynamic therapy, laser surgery, cryosurgery, intralesional antineoplastic agents, and various topical immunotherapies.[8-10]

The selection of a specific treatment modality for NMSC often depends on several factors, including tumor histopathology, anatomic location, patient characteristics, recurrence rate, adverse events, and patient and clinician preferences. Due to excellent cure rates, the majority of NMSCs are treated with surgical excision, which can include excision with standardized margins or Mohs micrographic surgery (MMS).[8] However, the above factors can dictate which therapy is optimal in each case, and it is important to counsel patients on the various options. Superficial radiation therapy (SRT) is a form of external radiotherapy that uses low energy, low penetration kilovoltage (kV) photons to preferentially target tumors of the skin and has been used for over 100 years to effectively treat skin cancers.[11] A newer form of this tool, image-guided superficial radiation therapy (IGSRT), utilizes high resolution dermal ultrasound (HRDUS) in conjunction with SRT to visualize tumors before, during, or after treatment.[12] As a newer treatment modality, there are limited guidelines on how IGSRT can fit into clinical practice. The purpose of this study was for a panel of experts in NMSC management to review the available literature and create recommendations on the role of IGSRT in treating NMSC.

## METHODS

### Literature Search and Study Selection

A comprehensive search of PubMed, EMBASE, Scopus, and Google Scholar was completed on October 15, 2024, using the keywords “image-guided superficial radiation therapy” and “skin cancer” along with the Boolean term “AND” for English-language original research articles, systematic reviews, and meta-analyses without date restrictions. Articles were screened for relevance to the topic of treating NMSC with IGSRT. The studies that met inclusion criteria were then distributed to the panelists for review. Each member of the panel assigned each article a level of evidence based on Strength of Recommendation Taxonomy (SORT) criteria.[13] These levels include level 1 (good-quality patient-oriented evidence such as systematic reviews or meta-analyses of good quality cohort studies or a prospective cohort study with good follow-up), level 2 (limited-quality patient-oriented evidence such as retrospective cohort studies or prospective cohort studies with poor follow-up), or level 3 (other evidence such as consensus guidelines, usual practice, opinion, or

disease-oriented evidence). Of note, a level 2 or 3 designation does not necessarily indicate a deficient study but is requisite for retrospective studies or basic science articles that focus on disease states, respectively.

### Development of Consensus Statements

The panel consisted of six board-certified dermatologists with expertise in managing NMSC. They convened on November 19, 2024, to discuss the studies and create consensus statements to guide clinicians on the use of IGSRT to treat BCCs and cSCCs. A modified Delphi process was used to reach consensus for each statement.[14] This process requires supermajority approval to adopt a statement through multiple rounds of real-time voting and is frequently used to create expert recommendations in dermatology.[15-17]

## RESULTS

### Literature Search and Study Selection

The initial search produced 87 articles that met search criteria. After removing duplicates and screening for relevance, 12 articles remained and were distributed to the panelists for review prior to the roundtable discussion. Of these 12 articles, the panel assigned level 1 evidence to three articles, level 2 evidence to two articles, and level 3 evidence to seven articles (**Table 1**). [18-29]

### Development of Consensus Statements

The panel created ten consensus statements related to the treatment of NMSC with IGSRT. Eight statements received a unanimous (6/6) vote for adoption and two statements received 5/6 votes for adoption. Eight statements were given a strength of recommendation of “A” while two statements were given a strength of recommendation of “B” (**Table 2**).

**Statement 1:** *SRT is a well-established modality for the treatment of NMSC, dependent on individual patient characteristics. ISGSRT adds US visualization that can help evaluate the depth and breadth of the tumor. (6/6; SORT Level A)*

SRT has been utilized for over a century to treat NMSC and there are several studies that have demonstrated its efficacy and safety.[28] A study of 85 patients with 115 biopsy-proven BCCs that were treated with SRT had a local control rate of 95% at 5 years using Kaplan-Meier estimates.[30] Another retrospective study of 175 BCCs diagnosed in 148 patients identified a 5-year recurrence rate of 15.8% ± 3.3% for all BCCs.[31] A larger study retrospectively analyzed 1,715 histologically confirmed primary, nonaggressive BCCs (n=712), cSCCs (n=994), and tumors with features of both (n=9) and identified a recurrence rate of 2.6% for all tumors treated with SRT with an average follow up of 31.5 months (range, 1 to 120 months).[32] Due to variability in follow up, the investigators used Kaplan-Meier estimates to estimate control rates and found a cumulative 5-year recurrence rate for all tumors of 5.0% (95% confidence interval (CI), 3.2%-6.7%). For BCCs the 5-year recurrence rate was 4.2% and for cSCCs (including invasive and in situ) it was 5.8% (2.9%-8.7%).[32]

IGSRT is similar to SRT but adds image guidance in conjunction with SRT. The technology typically uses US in order to visualize the dimensions of the tumor as well as its exact location within the surrounding tissue. There are different ways to perform IGSRT with a variety of dose regimens to choose from.[21] Protocols have been developed to help guide clinicians

**Table 1.** SORT criteria levels of evidence for included studies

| Article | Level of Evidence |
|---|---|
| Farberg AS, Heysek RV, Haber R, et al. Freedom from Recurrence across Age in Non-Melanoma Skin Cancer Treated with Image-Guided Superficial Radiation Therapy. Geriatrics (Basel). 2024;9(5):114. | 1 |
| Agha R, Heysek RV, Vasily DB, et al. Image-Guided Superficial Radiation Therapy for Basal and Squamous Cell Carcinomas Produces Excellent Freedom from Recurrence Independent of Risk Factors. J Clin Med. 2024;13(19):5835. | 1 |
| McClure EM, Cockerell CJ, Hammond S, et al. Image-Guided Radiation Therapy Is Equally Effective for Basal and Squamous Cell Carcinoma. Dermatopathology (Basel). 2024;11(4):315-329. | 1 |
| Yu L, Oh C, Shea CR. The Treatment of Non-Melanoma Skin Cancer with Image-Guided Superficial Radiation Therapy: An Analysis of 2917 Invasive and In Situ Keratinocytic Carcinoma Lesions. Oncol Ther. 2021;9(1):153-166. | 2 |
| Tran A, Moloney M, Kaczmarski P, et al. Analysis of image-guided superficial radiation therapy (IGSRT) on the treatment of early-stage non-melanoma skin cancer (NMSC) in the outpatient dermatology setting. J Cancer Res Clin Oncol. 2023;149(9):6283-6291. | 2 |
| Yu L, Moloney M, Tran A, Zheng S, Rogers J. Local control comparison of early-stage non-melanoma skin Cancer (NMSC) treated by superficial radiotherapy (SRT) and external beam radiotherapy (XRT) with and without dermal image guidance: a meta-analysis. Discov Oncol. 2022;13(1):129. | 3 |
| Yu L, Moloney M, Zheng S, Rogers J. High resolution dermal ultrasound (US) combined with superficial radiation therapy (SRT) versus non-image guided SRT or external beam radiotherapy (XRT) in early-stage epithelial cancer: a comparison of studies. BMC Cancer. 2023;23(1):98. | 3 |
| McClure EM, Sedor G, Jin Y, Kattan MW. Image-guided superficial radiation therapy has superior 2-year recurrence probability to Mohs micrographic surgery. Clin Transl Radiat Oncol. 2023;43:100678. | 3 |
| McClure EM, Sedor G, Moloney M, et al. "Image Guidance is Associated with Improved Freedom From Recurrence After Superficial Radiation Therapy for Nonmelanoma Skin Cancer." Advances in Radiation Oncology (2024): 101463. | 3 |
| Stricker JB, Hopkins J, Farberg AS, et al. "Understanding the Importance of Daily Imaging in the Treatment of Non-Melanoma Skin Cancer with Image-Guided Superficial Radiation Therapy." Dermato 4.3 (2024): 86-96. | 3 |
| Nestor MS, Berman B, Goldberg D, et al. Consensus Guidelines on the Use of Superficial Radiation Therapy for Treating Nonmelanoma Skin Cancers and Keloids. J Clin Aesthet Dermatol. 2019;12(2):12-18. | 3 |
| Han H, Gade A, Ceci FM, et al. Superficial radiation therapy for Nonmelanoma skin cancer: A review. Dermatological Reviews. 2022; 3(6), 409-417 | 3 |

**Table 2.** Consensus statements and recommendations for the use of IGSRT to treat NMSC with associated strength of recommendation based on SORT criteria.

| Consensus Statement/Recommendation | Strength of Recommendation | Consensus Vote |
|---|---|---|
| SRT is a well-established modality for the treatment of NMSC, dependent on individual patient characteristics. ISGSRT adds US visualization that can help evaluate the depth and breadth of the tumor. | A | 6/6 |
| IGSRT is a safe and effective treatment option for NMSC. | A | 6/6 |
| IGSRT with per-fraction imaging has been shown to have a high cure rate for NMSC. Additional studies are needed to elucidate if other imaging intervals are equally efficacious. | B | 5/6 |
| Dermatologists are the most appropriate clinician to direct and administer SRT including IGSRT. | A | 6/6 |
| SRT including IGSRT can be considered a first line treatment for NMSC for appropriately selected patients. | A | 6/6 |
| SRT including IGSRT may be the optimal treatment for certain patients dependent on individual patient factors, such as age, comorbidity, patient preferences, tumor location, and tumor histology, and other factors. | A | 6/6 |
| SRT including IGSRT may not be medically optimal in certain clinical situations. | A | 6/6 |
| Because studies have shown that IGSRT typically results in favorable cosmetic outcomes, in some cases it may be a preferred option for patients who want to optimize cosmesis. | B | 5/6 |
| Patients with NMSC need to be offered all appropriate treatment options and should be a part of the decision-making process. | A | 6/6 |
| Based on available data, SRT including IGSRT provides superior outcomes overall to electron beam radiation therapy for NMSC. | A | 6/6 |

administering IGSRT, and in 2019 a new protocol was developed with specific recommendations on for dose, fractionation, and energy, based on ultrasound-determined depth and tumor type.[21] However, the panelists note that different clinicians may perform IGSRT using different approaches with variations in both the SRT parameters that are used and the frequency of imaging.

**Statement 2:** *IGSRT is a safe and effective treatment option for NMSC. (6/6; SORT Level A)*

There are several studies that that have demonstrated that IGSRT is a safe and effective treatment modality for NMSC. A large, retrospective review, including 1,632 stage 0-II patients with 2,917 invasive and in situ NMSC lesions, collected data on the various treatment parameters including dose, duration of treatment, follow-up interval, and outcomes.[21] The mean total number of fractions was 20.1 (SD ± 0.71) and ranged from 20 to 30 while the mean total treatment dose was 5,219.9 centigray (cGy) (SD ± 224.47) and ranged from 3,716.0 to 7,363.7 cGy.[21] Most lesions were treated for 6-7 weeks and followed for an average of 69.8 weeks.[21] Out of the 2,917 treated tumors, 2,897 (99.3%) did not have evidence of disease at their last follow up, while 20 lesions (0.7%) did not completely respond to IGSRT or recurred.[21] While this is an excellent local control rate, the panelists did note that the mean follow up duration of approximately 70 weeks may not be long enough to capture all recurrences. They agreed that follow up of at least 5 years is optimal for assessing recurrence rates.

Another study from a similar data set evaluated 1,899 NMSCs treated with IGSRT with energies ranging from 50 to 100 kV for a mean of 20.2 fractions and treatment dose of 5,364.4 cGy.[22] These tumors were treated for a mean of 7.5 weeks and followed for a mean of 65.5 weeks.[22] Kaplan-Meier analysis was used to calculate local control rates and account for variations in follow up intervals.[22] The investigators found that local control was achieved in 99.7% of lesions. Using Kaplan-Meier analysis, local control was 99.41% at the maximum follow-up time of 63.6 months.[22] This study also found that IGSRT was safe and tolerable. Of the 1,196 lesions with Radiation Treatment Oncology Group Toxicity (RTOG) data available (acute radiation Dermatitis), only 5.1% were RTOG grade 3 or 4 in severity, which includes confluent, moist desquamation or pitting edema (grade 3) or ulceration, hemorrhage, or necrosis (grade 4).[22] The majority (94.9%) of lesions received RTOG grades of 1 or 2, consisting of mild or moderate self-resolving symptoms such as faint/dull erythema or decreased sweating (grade 1) or tender/bright erythema or moderate edema (grade 2).[22]

**Statement 3:** *IGSRT with per-fraction imaging has been shown to have a high cure rate for NMSC. Additional studies are needed to elucidate if other imaging intervals are equally efficacious. (5/6; SORT Level B)*

The two aforementioned studies used image guidance with each fraction in order to establish the field and visualize the lesion prior to treatment.[21,22] The ability to evaluate the dimensions of the lesion help to guide energy placement and dose selection. US assessment was also used during and after treatment to make real-time modifications and assess for treatment response. The panelists noted that additional studies are needed to determine how outcomes may differ, if at all, with other imaging intervals. The addition of US, however, does appear to be superior to SRT without image guidance. A meta-analysis compared SRT and external radiation therapy (XRT) to IGSRT using HRDUS.[24] The logistic regression analysis found that IGSRT was statistically superior to each of the 4 non-image-guided radiation therapy studies individually, collectively, and stratified by histologic subtype with p-values ranging from $p<0.0001$ to $p=0.0438$.[24] A retrospective cohort study evaluated 2-year freedom from recurrence rates of NSMSs treated with ISGRT to those treated with SRT using 1 sample proportion tests.[26] The

investigators found that all NMSCs treated with IGSRT in this cohort had an aggregate 2-year freedom from recurrence of 99.23%.[26] Patients treated with IGSRT were found to have a significantly lower recurrence rate compared to pooled data from two studies of patients treated with SRT (0.7% vs 5.8%, p<0.001).[26]

Stricker et al aimed to further understand the utility of daily imaging in a retrospective review of 1,507 cases of NMSC treated with IGSRT.[27] They found that 92% of NMSC lesions demonstrated daily depth fluctuations, which may lead to adaptive replanning.[27] In fact, 40% of the NMSC lesions in this study required at least 1 adaptive replanning during treatment.[27] This is significant as it can alter the percentage depth dose (PDD), or the percentage of the original radiation dose that is delivered at a given measured depth.[27] PDD determines what percentage of the prescribed radiation dose ultimately reaches a specific depth in the dermis, such as at the bottom of the tumor. HRDUS visualization allows for measurement of the actual delivered dose at the depth most at risk for reccurence.[27] The panelists noted that additional studies are needed to quantify how this may alter outcomes including safety and efficacy.

**Statement 4:** *Dermatologists are the most appropriate clinician to direct and administer SRT including IGSRT. (6/6; SORT Level A)*

Dermatologists have been performing SRT since its inception as they have a deep clinical and histologic understanding of NMSC and are typically the clinician that makes the initial diagnosis. They also know the risks and benefits of the various treatment options for NMSC, including SRT and IGSRT, and are equipped to have a robust discussion on benefits versus risks in order to decide which option would be most appropriate for each individual patient. Furthermore, they are adept at assessing treatment efficacy and toxicity. As a result, the panel concluded that dermatologists are the most appropriate clinician to administer these therapies. Additionally, all of the studies discussed above that document the efficacy of IGSRT were performed by dermatologists in conjunction with additional team members.[18-24] Thus, IGSRT can safely and effectively be performed in the outpatient setting, and a multidisciplinary team has the potential to support its delivery. This can include a radiation oncologist, radiation technician, medical physicist, and dosimetrist.

**Statement 5:** *SRT including IGSRT can be considered a first line treatment for NMSC for appropriately selected patients. (6/6; SORT Level A)*

Both SRT and IGSRT have been shown to be very efficacious for NMSC, with two retrospective cohort studies estimating local control rates of IGSRT to be greater than 99% in select cases.[21,22] Another retrospective study aimed to compare 2-year recurrence probability between IGSRT and Mohs micrographic surgery (MMS).[25] They found that the 2-year recurrence probability with MMS in one prospective cohort was 0.048 for SCC and 0.020 for BCC.[33] Two other retrospective cohort studies identified total NMSC 2-year recurrence probabilities with MMS to be 0.030 and 0.010.[34,35] However, the level of prognostic risk of the tumors in the studies was not fully evaluated. In a retrospective cohort study of IGSRT, the 2-year recurrence rate for BCCs was 0.011 and the recurrence rate for cSCCs was 0.008.[26] The authors concluded that IGSRT outperforms MMS for NMSC based on statistically significant superior 2-year recurrence probability.[25] However, this comparative evaluation does have some

notable limitations. The panelists discussed that these studies have different patient populations, dermatologists and Mohs surgeons, tumor characteristics, and a short follow-up period of 2 years. These different parameters may not allow for direct comparisons between the studies. However, the panel deemed that the overall data on IGSRT supports its use as a first-line therapy for NMSC in properly selected cases.

**Statement 6:** *SRT including IGSRT may be the optimal treatment for certain patients dependent on individual patient factors, such as age, comorbidity, patient preferences, tumor location, and tumor histology, and other factors. (6/6; SORT Level A)*

There are several situations in which SRT may be an optimal treatment for patients with NMSC. Some patients do not want to undergo surgery or have certain comorbidities that preclude them from surgery. Additionally, there are tumor characteristics, such as histology and location, that may be more suitable to SRT, including IGSRT, as opposed to other treatment modalities. Studies have examined the efficacy of IGSRT across different patient and tumor characteristics. One retrospective cohort study compared 2-, 4-, and 6-year freedom from recurrence in biopsy-proven NMSCs between patients younger than 65 years and patients 65 and older.[18] They found that overall freedom from recurrence rates were 99.68% at 2 years, 99.57% at 4 years, and 99.57% at 6 years, and that rates did not differ significantly by age (p=0.8) nor by sex among the two age groups (p>0.9).[18]

A similar study investigated freedom from recurrence rates with IGSRT stratified by tumor location, patient sex, and tumor stage in 19,998 NMSCs.[19] In this study, the 6-year freedom from recurrence was 99.53% for NMSCs on the head or neck and 99.56% for NMSCs in other locations, with no significant difference between the two recurrence rates (p=0.9).[19] Similarly, there were no statistically significant differences (p=0.4) in freedom from recurrence at 6 years when stratifying by patient sex. This is notable as male sex has been associated with worse NMSC outcomes, but the outcomes with IGSRT are similar. [36] When stratifying by tumor stage, both 4-year and 6-year freedom from recurrence rates were 99.79% for stage 0 tumors, 99.51% for stage 1 tumors, and 98.84% for stage 2 tumors.[19] The difference across these stages was statistically significant (p=0.004), however the authors concluded that since the freedom from recurrence rate was greater than 99% across all evaluated tumor stages, the data supports IGSRT as highly effective treatment for these skin cancers.[19] Another study of this same cohort of 19,998 NMSCs found that the efficacy of IGSRT was not impacted by tumor histology (BCC, cSCC, or cSCC in situ) or histologic subtype (nodular BCC, superficial BCC infiltrating BCC, morpheaform BCC, well-differentiated SCC).[20] The panelists noted the importance of the 6-year follow-up data for evaluation of recurrence and the evaluation of histologic subtypes of NMSC.

**Statement 7:** *SRT including IGSRT may not be medically optimal in certain clinical situations. (6/6; SORT Level A)*

SRT and IGSRT may not be optimal for certain high-risk tumors. Studies have not investigated its efficacy for high-risk stage 3 or stage 4 tumors. Additionally, there is no data available on its use for recurrent NMSCs. Other tumor types, such as tumors with perineural invasion or deep tissue invasion, cutaneous T-cell lymphomas, dermatofibrosarcoma protuberans, and certain melanomas should be treated with other forms of radiation therapy besides SRT

when radiation therapy is utilized.[28] Additionally, in cases where there has been prior radiation at the treatment site, or the patient has a genetic predisposition to malignancy (e.g. BCC syndrome, Gardner's syndrome, Li-Fraumeni syndrome, xeroderma pigmentosum), SRT may be contraindicated.[29]

**Statement 8:** *Because studies have shown that IGSRT typically results in favorable cosmetic outcomes, in some cases it may be a preferred option for patients who want to optimize cosmesis. (5/6; SORT Level B)*

A cohort of 93 patients with 133 biopsy-confirmed NMSCs treated with IGSRT was retrospectively analyzed to assess outcomes including cosmesis, as assessed by the clinician.[36] Cosmesis was thought to be excellent or very good in all cases, with no "fair" or "poor" cosmetic outcomes.[36] SRT, including IGSRT, can also have particularly favorable cosmetic outcomes on the nasal alar rim, ear, perioral, and periorbital areas.[28,37-42] A retrospective cohort of 47 patients with NMSC of the lip treated with SRT demonstrated local control in 91% of cases with investigators identifying a good cosmetic outcome in the majority of cases.[43] All but one of these patients had fully preserved vermilion lip functionality.[43] For patients that are hesitant to pursue surgery in cosmetically-sensitive areas and want to avoid the risk of developing a surgical scar, IGSRT can be a great option. Additionally, the lower extremities are an area that can heal slowly or incompletely due to poor circulation. This can lead to poor cosmetic outcomes and adverse events. Surgical site infection rates for wide MMS and wide local excisions below the knee range from 2.3 to 8.3%, respectively.[44] A study of 151 NMSCs on the lower extremity treated with SRT showed that there were no treatment-related infections.[45]

**Statement 9:** *Patients with NMSC need to be offered all appropriate treatment options and should be a part of the decision-making process. (6/6; SORT Level A)*

There are several ways to treat NMSC, each with associated pros and cons. In choosing the optimal therapy, it is important for the patient to understand the risks and benefits of the various treatment options so that they can make an informed decision. A systematic review found that most patients are interested in shared decision making (SDM) conversations focusing on efficacy, risks, costs, safety, tolerability, post-procedural implications and activity limitations, and other individual concerns.[46-48] Patients also appreciate physician attributes of empathy, knowledgeability, and a willingness to have the conversation. The review found that physicians who use SDM noted improved patient satisfaction.[46] Since there are several safe and effective treatment modalities for NMSC and advantages and disadvantages to each, patients can particularly benefit from a thorough conversation of the different options so that they feel well-informed.

**Statement 10:** *Based on available data, SRT including IGSRT provides superior outcomes overall to electron beam radiation therapy for NMSC. (6/6; SORT Level A)*

Another commonly used form of radiation therapy in the treatment of skin cancer is electron bean radiation therapy (EBRT). EBRT uses a uniform radiation dose with energies ranging from 4 to 20 MeV to treat a depth of 2-6 cm below the epidermis.[49] The beam and delivered dose with SRT has much less lateral beam edge drop off (1mm) at the treatment site compared with EBRT (8-10mm), resulting in less healthy tissue being irradiated.[50] Additionally, studies have shown that the local cure rates are superior with SRT

and IGSRT compared to EBRT. A retrospective analysis of 339 consecutively treated, biopsy-proven NMSCs treated with either EBRT or SRT showed that the overall tumor control rate for SRT was 98% for tumors less than 1 cm, 93% for tumors 1.1 to 5 cm, and 100% for tumors greater than 5 cm.[51] For EBRT, the tumor control rate was 88%, 72%, and 78% for each of these size ranges, respectively.[51] A meta-analysis of six studies also showed that IGSRT achieved superior local control rates compared to both external radiation therapy and non-image-guided SRT.[24]

## CONCLUSION

This expert panel of dermatologists created ten consensus recommendations on the use of IGSRT to treat NMSC, supported by multiple studies. Overall, the panel recommends IGSRT as a safe and effective treatment modality with highly favorable cosmetic outcomes for NMSC. They highlighted particular cases in which IGSRT can be considered optimal as first-line therapy for NMSC, as well as cases in which it is not recommended or contraindicated. Given the importance of shared decision making, they emphasized the need to discuss the risks and benefits of all available options when creating a treatment plan, incorporating patient preferences, patient history, and tumor characteristics into the final management decision.

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