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Original Research Article

A split-face randomized controlled trial comparing high and low power electrosurgical settings in the treatment of dermatosis papulosa nigra

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ABSTRACT

Background: Dermatosis papulosa nigra (DPN) is a benign skin condition affecting predominantly individuals with Fitzpatrick skin type IV-VI. Electrosurgical treatment is cheaper and readily available, but optimal power settings remain undefined. The aim of this study is to compare the efficacy, safety, and cosmetic outcomes of high- versus low-power electrosurgery settings in the treatment of DPN.
Methods: A split-face, evaluator-blinded, randomized controlled trial, 58 participants with Fitzpatrick skin types IV–VI underwent treatment using both high-power and low-power electrosurgical settings (each set at 9 Watts) on opposite sides of the face or neck. Outcomes—lesion clearance, scarring, and pigmentation—were assessed via standardized photography two weeks post-procedure by blinded dermatologists.
Results: High-power settings resulted in higher lesion clearance (82.8% versus 77.6%, $p<0.001$) but were associated with significantly more moderate scarring and pigmentation. Low-power settings showed better cosmetic outcomes (mild scarring: 93.1% versus 87.9%; mild pigmentation: 87.9% versus 72.4%). Overall efficacy, defined as excellent clearance (>85%) with minimal cosmetic side effects, did not differ significantly between groups ($p=0.56$).
Conclusions: Although, low-power setting electrosurgery of DPN offers comparable efficacy to high-power settings, it may require more treatment cycles to eliminate all lesions. It is also the preferable setting for individuals prone to scarring or pigmentary changes.

Keywords: High-power setting, Low-power setting, Electrosurgery, Dermatosis papulosa nigra, Efficacy

INTRODUCTION

Dermatosis papulosa nigra (DPN) are benign epidermal growths, characterized by superficial, dark coloured, cerebriform papules.[1] They develop predominantly on the face, neck, and upper trunk, of dark skin individuals.[2,3] They are usually asymptomatic, though may be a source of irritation when located on skin folds. They can also be cosmetically disfiguring and can have moderate effect on the quality of life of affected individuals.[4] DPN develops during puberty, the size and number of lesions vary among individuals, some may present with more than 500 lesions at any given time. Treatment of DPN has not been standardized and types of treatment include electrosurgery, cryotherapy, curettage, dermabrasion and various types of lasers.

Electrosurgical procedures are one of the few traditional treatment modalities used in the treatment of DPN.[5] Examples of various modalities of electrosurgery used in dermatology include electrocautery, bi-terminal electrocoagulation, electrolysis and electrosection. Electrosurgery technique involves the conversion of electrical energy to heat from the resistance created by the poor conducting properties of the skin.[5,6] The electrosurgical devices typically offer a range of power

settings, including low and high, to accommodate different surgical needs such as tissue destruction and haemostasis. Unlike fully powered electrosurgical units used in major surgeries, the electrosurgical devices designed for minor dermatologic procedures, offer precise energy delivery without the need for grounding pads.[6]

Key features of these devices are the adjustable power settings, allowing for customization of energy levels, provision for controlled tissue destruction and their simplicity and affordability. Due to these key features, electrosurgical devices are the preferred treatment option for DPN especially in low-income countries where patients pay out-of-pocket. The selection of power settings plays a crucial role in determining treatment outcomes. The low-power settings with a power of 3-5 watts can be used for superficial tissue destruction and has minimal risk of scarring and post-inflammatory dyspigmentation unlike the high-power settings with a power of >10 watts.[5,7] There is no universally accepted protocol regarding the ideal power settings of the electrosurgical device when treating DPN. There is a need to study whether low power hyfrecator offers superior cosmetic results with fewer complications compared to high-power settings, or whether the latter provides more efficient lesion removal without significantly increasing risks. The findings will help dermatologists refine their approach to treating DPN, particularly in patients with darker skin tones. This study aims to evaluate the effectiveness, safety, and cosmetic outcomes of high vs. low power electrosurgery setting in the treatment of DPN to determine the optimal approach for care of patients with Fitzpatrick skin type IV to VI.

METHODS

Study design

This was a split-face, randomized controlled, evaluator-blinded, single-centre study to compare the efficacy and safety of high-power electrosurgery treatment setting with the low-power treatment setting in patients with DPN.

Setting and participants

The study was conducted at dermatology clinic in Abuja, Nigeria between March 2024 and May 2025. The study protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki as reflected in its approval by the University of Abuja Teaching Hospital Health Research Ethics Committee Board (approval number UATH/HREC/PR/386) and all study participants signed an informed consent prior to enrolling in the study.

Study population

Healthy individuals were recruited consecutively from local communities and the hospital through advertisements and word-of-mouth referrals. Study participants were males and nonpregnant or lactating females who have been clinically diagnosed with DPN by dermatologists, aged 18 to 65 years.

Inclusion criteria

Participants with DPN lesions on both sides of the face or neck, who were healthy with no underlying debilitating health concerns were recruited into the study.

Exclusion criteria

Individuals with a pacemaker or cardiac defibrillator, who were allergic to topical anaesthetic medications and adhesives, and prone to hypertrophic and keloidal scarring were excluded.

Procedure

The site, number and morphology of the lesions were documented. The types DPN (sessile, pedunculated, keratotic plaques) were counted, and a pre-procedure photograph was taken using a smart phone. The allocation of treatment sides was performed using simple randomization by an independent investigator not involved in outcome assessment. One side of the face or neck was randomly assigned to receive the high-power electrosurgical setting, while the contralateral side received the low-power setting.

Pre-treatment, a topical anaesthetic (2.5% lignocaine + 2.5% tetracaine) was applied under occlusion for 30 mins. The cream was applied uniformly (as is done during routine dermatology clinic setting) in a layer approximately 1 to 2 mm thick by an unblinded study nurse and covered with a transparent polyurethane dressing to enhance penetration. After 30 minutes, the cream is removed with cotton gauze.

Both procedures were undertaken using the Hyfrecator 2000, ConMed Corporation, Utica, NY, electrosurgical machine. Participants were not blinded. Both high and low power settings were set at 9 watts. According to the manufacturer, when both settings are set to same wattage, the high setting should deliver a more intense, broader arc of current, leading to deeper tissue destruction, while the low setting provides a more precise and superficial effect with a smaller arc of current. A power setting of 9 watts was selected based on findings from a preliminary pilot study, which demonstrated that this setting consistently achieved effective tissue destruction across all morphological types of DPN lesions. Immediately after each procedure, participants filled out a questionnaire on their level of pain and burning sensation comparing the two sides using a patient assessment scale from 0 to 10. They were assessed for swelling, redness, and crusting immediately. Standard post-care treatment for both sides of the face included topical antibiotics to be applied twice daily for a period of seven days and sunscreen cream (SPF 50) for four weeks. They returned to the clinic two weeks later, where the outcome was assessed, and photographs

were taken. Photographs of a region of the face or neck containing at least 10 lesions were taken to assess treatment outcomes, such as the forehead, malar, periorbital, neck and chin.

Outcome measures

Efficacy of both procedures was assessed by two dermatologists who compared pre- and 2-week post-treatment photographs of each side of the face or neck. The assessors were blinded to the treatment settings. They rated lesion clearance, scarring, and pigmentation. Clearance was determined by counting lesions on the before and after photographs and calculating the percentage reduction. Clearance was categorized as 86–100%, 51–85%, or <50%. Scarring and pigmentation were each graded as mild, moderate, or severe depending on the number of treated lesions with these outcomes in the post-procedure photographs. Treatment efficacy was evaluated based on the combined difference in number of lesions, degree of post-procedure scars and pigmentation between the before and after photographs. The treatment with higher efficacy was defined as >85% lesion clearance with minimal or no scarring and pigmentation.

Statistical methods

A minimum sample size of 55 participants was calculated assuming a significance level of 0.05 and a power of 80% (1-β=0.8), to detect a 1-unit difference in efficacy between the treatment with the high-power and low-power settings applied to opposite sides of the face or neck with a split-face ratio (1:1). A margin of 0.3 was specified, and a 10% anticipated dropout rate was factored into the calculation. Data was analysed using IBM statistical package for the social sciences (SPSS) statistics, version 25. Descriptive statistics, including frequencies and percentages, were used to compare the distribution of outcome measures between the high-power and low-power treatment settings on each side of the face. Cohen's kappa statistic was used to evaluate the level of inter-rater agreement among the assessors: values between 0.41 and 0.60 were interpreted as moderate agreement, while values above 0.70 were considered to reflect high agreement.

Chi-square tests were employed to determine whether there were statistically significant differences in treatment outcomes between the two sides of the face. Additionally, the McNemar test was used to assess whether the proportion of participants achieving the higher efficacy differed significantly between the high-power and low-power treated sides.

RESULTS

Sixty-nine participants were enrolled in the study (Table 1), and 58 participants completed the study per protocol, while the remaining did not return for follow-up visit, two weeks after the procedure and so there were no after-photographs to assess. The mean age and age range of participants was 46.6 years (23-65) years. There were 51 females and 7 males who were recruited into the study. Participants had Fitzpatrick skin type IV to VI. Of the 58 participants who completed the study, ten had lesions on the neck.

Table 1: Participant demographics.

Characteristics	Number (N)
Total enrolled	69
Completed study	58
Lost to follow-up	11
Mean age (years)	46.6
Age range (years)	23–65
Sex (F:M)	51:7
Fitzpatrick skin type	IV–VI

Cerebriform-shaped lesions (sessile DPNs) were observed in 98% of participants. The smallest lesions measured 1 mm in diameter and 1 mm in height. One participant had flat keratotic DPNs which measured 5 mm by 1 mm, and another had pedunculated DPNs, with dimensions of approximately 1 mm in diameter and 3 mm in height. Treatment with the high-power setting was associated with greater pain scores (ranging from 8 to 10) compared to the low-power setting (5 to 9). However, no participant discontinued the procedure due to pain.

There was a moderate agreement between the two assessors for clearance using high-power setting, k=0.51 (95% CI, 0.24 to 0.79), p<0.001 and a high agreement for clearance using low-power setting, k=0.71 (95% CI, 0.51 to 0.90), p<0.001. The number of participants with excellent clearance (86–100%) in the high-power treatment group was 48 (82.8%) and in the low-power treatment group was 45 (77.6%), this difference was statistically significant, p<0.001.

The number of participants with mild scarring in the high-power treatment group was lower than in the low-power treatment group (table 2), this difference was statistically significant, p=0.004; while the number of participants with mild post-procedure pigmentation in the high-power treatment group was lower than in the low-power treatment group, this difference was statistically significant, p=0.014. The clinical picture of pre- and post-treatment using low-power is as shown in Figure 1 while that for high-power is shown in Figure 2.

Treatment efficacy is summarized as the difference in the presence of lesions, post-procedure scarring and pigmentation at week 2 post-treatment versus that at the baseline. The higher efficacy is scored as the presence of excellent clearance, nil or mild scarring and pigmentation. Higher efficacy was observed in 34 (58.6%) of participants in the high-power treatment group and in 38 (65.5%) of participants in the low-power treatment group. There was no statistically significant difference observed between the two settings (Chi-square 0.346, p=0.56).

Table 2: Post-procedure outcomes by treatment group.

Outcome	High-power group N (%)	Low-power group N (%)	P value
Mild scarring	51 (87.9)	54 (93.1)	0.004**
Mild pigmentation	43 (72.4)	51 (87.9)	0.014**

**Statistically significant.



Figure 1: (a and c) Before and (b and d) post-procedure photographs of low-power treatment, showing >85% clearance, mild scarring and pigmentation

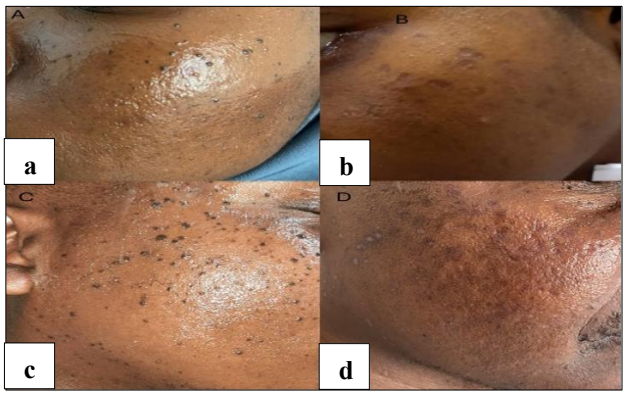


Figure 1: (a and c) Before and (b and d) post-procedure photographs of high-power treatment, showing >85% clearance with severe scarring and pigmentation.

DISCUSSION

This study compared the efficacy, cosmetic outcomes, and patient-reported tolerability of high-power versus low-power electrosurgical settings in the treatment of DPN using a split-face randomized controlled design. Of the 69 participants enrolled, 58 completed the study, representing a robust follow-up rate for an interventional dermatologic study. The mean age of participants was 46.6 years, with a predominance of females and Fitzpatrick skin types IV and VI, consistent with the known epidemiology of DPN, which disproportionately affects individuals with darker skin tones, especially those of African and Asian descent.[1-3]

The morphological profile of cerebriform-shaped sessile lesions in 98% of participants aligns with previous descriptions of DPN morphology.[1,3] Although some participants exhibited keratotic and pedunculated variants, these were relatively uncommon, highlighting the heterogeneity in clinical presentation.

High-power treatment was associated with higher pain scores, yet all participants completed the procedures, indicating that discomfort was tolerable under topical anaesthesia. This finding is consistent with existing literature suggesting that higher energy settings in electrosurgery can increase thermal injury and sensory nerve stimulation, potentially leading to greater discomfort.[8,9]

This study demonstrated a statistically significant higher rate of excellent clearance (86–100%) in the high-power setting compared to the low-power setting. However, this superior clearance came at the cost of increased post-procedural scarring and pigmentation changes. Specifically, low-power settings were associated with a significantly higher proportion of participants reporting only mild scarring and pigmentation, suggesting better cosmetic outcomes. This is similar to the study by Maruma et al who observed very low numbers with scarring following treatment with low-intensity electrodessication.[9]

Importantly, when efficacy was defined as the combination of excellent clearance and minimal cosmetic side effects (scarring and pigmentation), there was no statistically significant difference between the two settings. This indicates that although the high-power setting may slightly improve lesion clearance, the trade-off in cosmetic outcomes may not justify its routine use, particularly in individuals with darker skin tones who are at increased risk for post-inflammatory hyperpigmentation and keloid formation.[10-12] Additionally, it suggests multiple treatments when using low-power settings.

Inter-rater agreement analysis showed moderate concordance for high-power assessments and higher agreement for low-power settings. This may reflect more consistent and predictable cosmetic outcomes with the low-power modality, which further supports its reproducibility and reliability in clinical practice.[13]

Limitations

The follow-up period was limited to two weeks, which may not adequately capture delayed complications such as post-inflammatory hyperpigmentation, keloid formation, or long-term recurrence rates. Future studies with longer follow-up are necessary to evaluate sustained efficacy and safety profiles. While the split-face design minimizes

inter-individual variability, it may introduce cross-contamination effects or healing interactions between treated areas, potentially confounding the assessment of side-specific outcomes. The evaluation of treatment outcomes relied on photographic comparison by dermatologists, which, although conducted in a blinded and standardized manner, remains subject to inter-rater variability and interpretation bias despite efforts to quantify agreement using Cohen's kappa. The study population consisted predominantly of females and individuals with Fitzpatrick skin types IV and VI. While appropriate for a condition most common in darker skin types, this limits the generalizability of the findings to lighter skin tones and male populations. Pain assessment was based on subjective self-reporting immediately after the procedure. Objective or repeated assessments could provide a more nuanced understanding of patient discomfort and tolerability.

CONCLUSION

In conclusion, both high- and low-power hyfrecator settings are effective for DPN treatment. However, the low-power setting appears to offer a more favourable balance between lesion clearance and cosmetic outcomes. Its safety profile and reproducibility make it a suitable first-line option, particularly in populations at higher risk for pigmentary complications. Future research should assess long-term outcomes, recurrence rates, and patient satisfaction beyond the two-week follow-up.

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