

Comparison of the efficacy and safety of three different depilatory methods

Peter Bjerring, Henrik Egekvist and Thomas Blake

Department of Dermatology, Marselisborg Hospital, University Hospital of Aarhus, Aarhus, Denmark

Background/aims: Three methods of electrical energy-based depilation were compared for safety and efficacy.

Methods: Ten volunteers had one treatment with each device followed by weekly observations up to 9 weeks. The protocol used was basically that of the International Guild of Professional Electrologists, which is used to define "permanent" hair removal.

Results: Radio frequency tweezers, direct current tweezers and needle based electrolysis all demonstrated statistically significant reductions in hair counts after 9 weeks of 60.3%, 65.8% and 55.9%, respectively. The differences between the treatments were not statistically significant. However, large differences in side effects and pain scores existed. Both tweezer type epilators induced pain rated at 13/100 on a visual analogue scale while

the needle based depilator induced significant pain at 59/100. Furthermore, acute inflammation and late scarring was seen only following treatment with the electrolysis needle.

Conclusion: The tweezer-type epilators are as effective as needle-based electrolysis but without the pain and side effects of the latter.

Key words: electrolysis – hair removal – tweezer-type epilator – pain score – scarring

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FOR THE LAST 122 years electrical current has been utilized for removal of unwanted hair (1). Most widespread is the method of electrolysis whereby the electrical current is delivered to the hair follicle by introduction of a needle along the hair shaft into the skin. Hair follicles are destroyed either by the thermal effect of the electric current or by the formation of NaOH resulting from the electrolytic reaction. It is an invasive technique, which is painful (2), and with a potential for side effects, e.g., inflammatory papules, ulceration, and scarring (3–5).

More recent hair removal techniques avoid use of a needle by utilizing the conducting properties of the hair shaft to deliver destructive energy to the hair follicle. One method delivers direct current to the hair shaft by electrically conducting tweezers, another applies radio frequency waves similarly (6, 7).

Until now only little information has been available by which the relative efficacy and safety of different methods could be judged. Therefore this present investigation was undertaken in order to compare the relative safety and effectiveness of needle-based electrolysis and two different types of tweezer-type epilators using long accepted methodology developed by the International Guild of Professional Electrologists (IGPE) (8).

Material and Methods

Volunteers

Ten adult volunteers [7 men and 3 women, mean age 38.3 (23 to 55) years] participated in the study. Here the protocol differed slightly from the IGPE guideline, which restricted the age group to between 20–30 years. None of the volunteers had any prior skin disease. All participants were of Caucasian origin. The volunteers gave their written informed consent and the study was approved by the Regional Scientific Ethical Committee according to the Declaration of Helsinki.

Depilatory devices

Three methods of electrical energy-based depilation were compared based on: 1) needle electrolysis (professional) system (Epilot K2000, Nemectron, Germany), 2) radio frequency tweezer-type (consumer use) epilator (Finally Free Ultra, Mehl Group Marketing, USA), and direct current tweezer-type (professional) epilator (Guaranty Hair Removal Epilator 629, Stephens Manufacturing, USA).

Evaluation of efficacy

For the evaluation of efficacy, the basic protocol of the International Guild of Professional Electrologists

(IGPE) for evaluation of permanent hair removal was used (7). This protocol defines permanency as at least 40% hair removal after 9 weeks. Recognized by the U.S. Food and Drug Administration (FDA) as a Performance Standard, it is the basis by which that government agency allows "permanent hair removal" claims for depilatory devices. In contrast to the IGPE protocol, however, no attempt was made to identify and discount anagen hair at 2 weeks, thus causing the present study results to be more conservative than would normally be reported.

Evaluation of pain in relation to the depilation procedure

All three depilation types were performed during the same session in randomized order. Pain was scored immediately after each treatment procedure on a 100 mm visual analogue scale (VAS). The value 0 was defined as *no pain*, and 100 was *worst imaginable pain*.

Evaluation of side effects

Inflamed hair follicles (papules) were counted 24 h after treatment. Side effects were defined as visible skin changes following the depilatory treatments. These were observed and scored 1 week after treatment as follows: 0: no visible changes; 1: <5 papules, no erythema; 2: 5–10 papules and/or slight erythema; 3: >10 papules and/or moderate erythema. Late effects were scored as number of scars present within each test area.

Depilation procedure

On the middle 1/3 of the right lower leg four test areas were marked, each containing 50 hairs. A plastic film template was made in order to accurately delineate the individual test areas for subsequent direct hair counting and close-up photography.

The test areas would each be treated with one of the three test devices; a fourth untreated area served as a control. The actual treatment of each area was determined by randomization. The treatments were performed by certified, experienced electrologists according to the manufacturers' guidelines.

Hair counts

Direct hair counts were performed at baseline, then 2 and 9 weeks post-treatment using a plastic film grid and close-up photography. This allowed the counts to be made in a blinded fashion.

Statistics

The ANOVA and the Mann-Whitney test were used. The significance level was 5%.

Results

Efficacy

After 9 weeks, all three methods induced a statistically significant reduction in hair number compared to the control area. The variation in efficacy between the three methods was, however, not statistically different. The Finally Free radio frequency device reduced the mean hair count by 60.3% (SD: 19.8%); the Guaranty Hair Removal DC tweezer reduced the mean hair count by 65.8% (SD: 21.9%); and the needle electrolysis system reduced mean hair count by 55.9% (SD: 21.3%). By contrast, the mean hair count in the control area showed a 3.5% (SD: 12.7%) increase in hair number after 9 weeks (Table 1).

Pain associated with the treatments

The pain associated with the three different treatments was scored by each volunteer on a 100 mm long visual analog scale (VAS) just after the treatment.

TABLE 1. Hair counts at 0, 2 and 9 weeks after a single treatment with three electrical hair removal devices

Patient No.	Finally Free					Guaranty Hair Removal					Electrolysis					Control Area				
	Weeks			Difference	% Reduction	Weeks			Difference	% Reduction	Weeks			Difference	% Reduction	Weeks			% Change	
	0	2	9			0	2	9			0	2	9			0	2	9		
1	62	11	28	17	72.58	60	12	25	13	78.3	66	10	48	38	42.4	55	46	56	101.8	
2	50	3	32	29	42.00	62	3	46	43	30.6	52	2	44	42	19.2	54	46	51	94.4	
3	52	9	25	16	69.23	58	6	23	17	70.7	52	8	27	19	63.5	47	44	47	100.0	
4	69	17	34	17	75.36	72	8	41	33	54.2	63	12	42	30	52.4	43	55	40	93.0	
5	57	10	29	19	66.67	87	21	38	17	80.5	56	12	45	33	41.1	49	68	67	136.7	
6	100	10	30	20	80.00	95	29	33	4	95.8	56	18	22	4	92.9	80	76	78	97.5	
7	63	21	37	16	74.60	62	19	33	14	77.4	65	11	36	25	61.5	57	5	62	108.8	
8	60	4	41	37	38.33	62	1	38	37	40.3	67	1	22	21	68.7	55	56	58	105.5	
9	60	12	60	48	20.00	45	4	29	25	44.4	52	7	38	31	40.4	54	50	51	94.4	
10	69	38	63	25	63.77	84	22	34	12	85.7	61	16	30	14	77.0	65	67	67	103.1	

TABLE 2. Subjective pain reading on a 100 mm visual analogue scale (0=no pain, 100=worst imaginable pain)

Patient no.	Finally free	Guaranty Hair Removal	Needle electrolysis
1	8	6	42
2	13	6	94
3	9	8	39
4	9	18	8
5	6	8	88
6	12	17	9
7	22	35	85
8	9	17	49
9	2	5	86
10	40	11	87

TABLE 3. Number of inflammatory papules in each test area 24 h after a single treatment with three hair removal devices

Patient no.	Finally free	Guaranty Hair Removal	Electrolysis	Control
1	1	0	51	0
2	0	0	0	0
3	0	0	16	0
4	0	0	5	0
5	0	0	23	0
6	0	0	8	0
7	4	3	43	0
8	0	0	47	0
9	0	0	31	0
10	0	0	7	0

The Finally Free tweezers induced a mean pain score of 13.0 (SD: 10.8), the Guaranty Hair Removal tweezers induced a score of 13.1 (SD: 9.2), and the Nemelectron needle-based electrolysis system induced the highest pain rating of 58.7 (SD: 37.6) (Table 2). The pain experienced during treatment with Finally Free was not statistically different from the pain experienced during treatment with Guaranty Hair Removal, but both of these were statistically less painful than the needle based electrolysis ($P<0.01$).

Safety

Immediate side effects were scored 24 h after the treatments. The side effects observed in the test sites treated with the tweezers-based systems, Finally Free and Guaranty Hair Removal, were very moderate, only reaching score 1 in 2/10 and 1/10 volunteers, respectively, whereas needle electrolysis reached score 3 (maximum) in 6/10 volunteers and score 2 in 3/10. The mean number of papules after needle electrolysis was 23.1, ranging from 0 to 51 papules per test area (Table 3).

Late side effects were scored as number of scars present within each test area after 9 weeks. Three vol-

unteers undergoing needle electrolysis demonstrated 13–30 discrete scars. The other two treatments produced no scars.

Discussion

Electrodepilation methods that apply direct current, high-frequency alternating current or pulsed high-frequency alternating current with either tweezers or a needle inserted directly into the hair follicles are – to the best of our knowledge – the most frequently used professional methods for depilation (4, 7). These three methods were compared in the present study with regard to efficacy and side effects, evaluated as pain, acute inflammation and late scarring associated with the treatment. In the present study, we found no statistically significant difference between the three methods in hair removal abilities 9 weeks after a single treatment. Furthermore, all three methods exceeded the standards for “permanent hair removal”, as defined by the International Guild of Professional Electrologists and recognized by the FDA (8). Radio frequency waves applied through tweezers on individual hairs for several seconds provide the most painless method, followed by the tweezer-based direct current. The needle-based, pulsed alternating current is significantly more painful than either of the two other methods. Also, inflammation and scarring are significant with needle-based therapy, but virtually nonexistent with the tweezer devices. Using the present standard observation time of 9 weeks, it is therefore concluded, that electrodepilation with needle-based systems should not be used, because safer and far less painful tweezer-based systems are equally effective.

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Address:
Peter Bjerring
Department of Dermatology
Marselisborg Hospital
University Hospital of Aarhus
P.P. Ørumsgade 11
DK-8000 Aarhus
Denmark

Tel: +45 4063 4878
Fax: +45 87415123