



Micro-Needling (MN), eine Behandlung mit vielseitigen Indikationen

Lars-Peter Kamolz





Journal of Plastic, Reconstructive & Aesthetic Surgery (2018) 71, 1–14



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Review

## Microneedling: Where do we stand now? A systematic review of the literature

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MN has emerged as a promising technology for cosmetic, therapeutic and diagnostic applications.

The therapeutic applications of MNs involve localized or systemic delivery of the drugs or biologics!



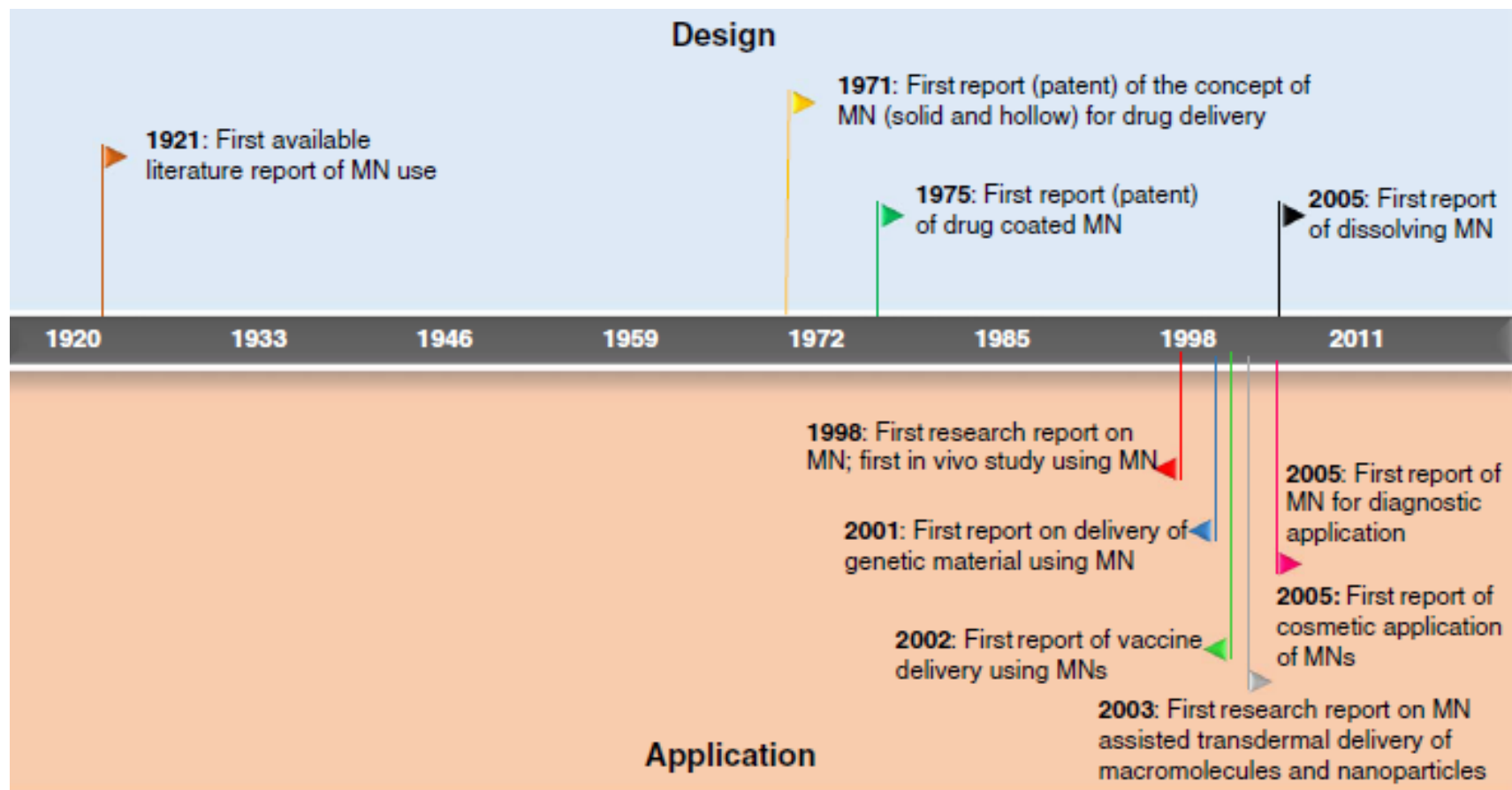


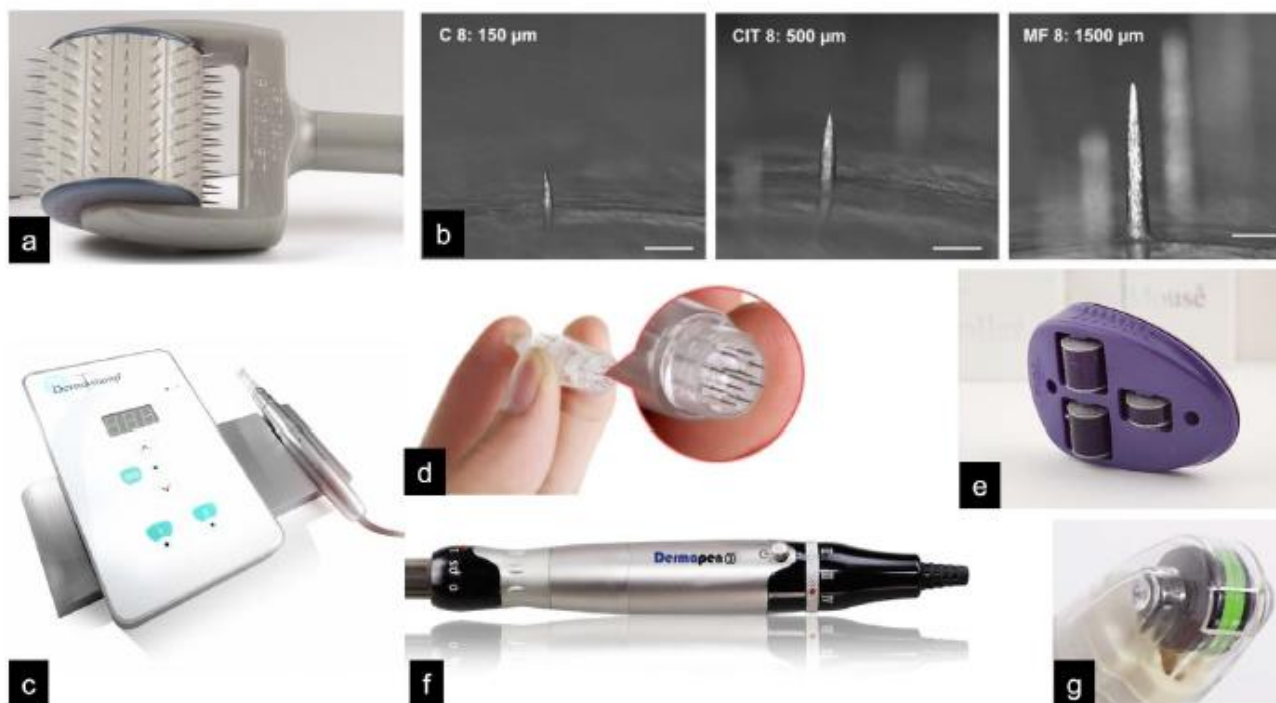
Fig. 1. Chronological timeline of MN development with important design and application milestones.





0,5- 3mm, DM 0,1- 0,25 mm

Cosmetic - Scar bundles



**Fig. 3.** Microneedling devices. (a) A typical Dermalroller<sup>®</sup> design with needles, drum and a holder [20]; (b) Scanning electron micrographs of a single needle from different Dermalroller<sup>®</sup> devices (C-8, CIT 8, MF 8), Scale bar: 500 µm [21]; (c) The Dermastamp<sup>®</sup> assembly with a Dermastamp<sup>®</sup> tip (d) [22]; (e) Beauty Mouse<sup>®</sup> with its three Dermalroller<sup>®</sup> design; [23] (f) The marketed Dermapen [24]; (g) The DermaFrac<sup>™</sup> design with the MN roller [25].

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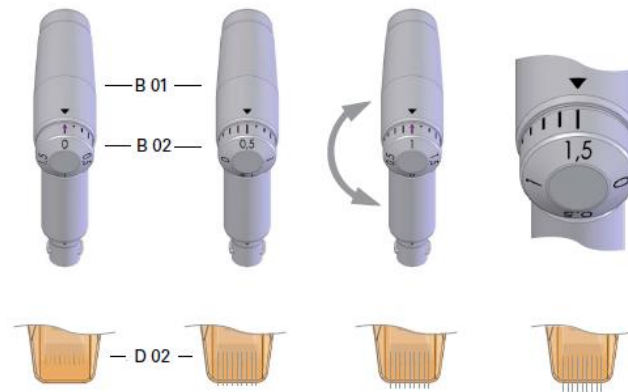


## SKINrePEN

Micro-Needling

The needle module „BLUE“ (D 01) is equipped with **5 needles** and suitable for small batches.

The needle module „ORANGE“ (D 02) is equipped with **9 needles** and is particularly suitable for larger areas (scars and stretch marks).





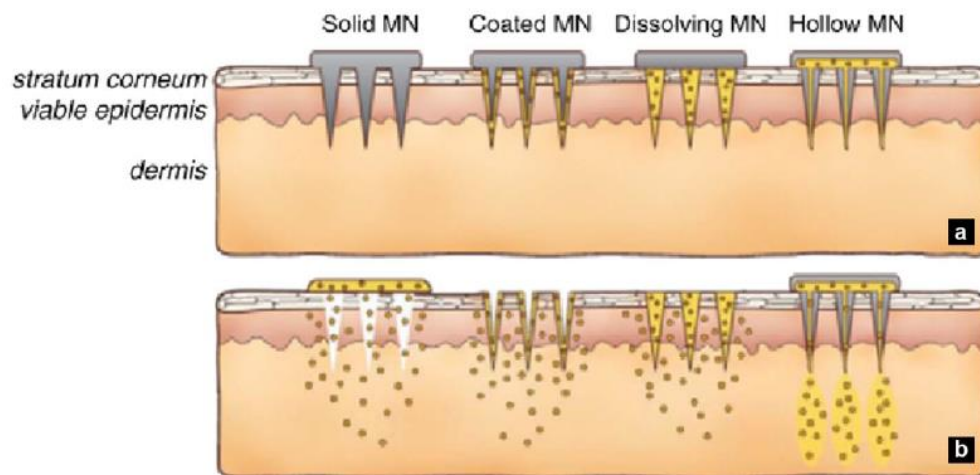


Fig. 5. Different mechanisms of MN applications in the skin (a) and respective drug release strategy (b). Solid MNs are used to pre-treat the skin followed by application of topical/transdermal formulation containing the drug which diffuses through the micro-channels created in the skin ("poke and patch" approach). For coated MNs, the drug diffuses into the skin upon insertion of the MNs into the skin ("coat and poke" approach). In the case of dissolving MNs, the therapeutic agent is encapsulated in a dissolvable/biodegradable matrix which releases the drug upon insertion into the skin ("poke and release" approach). In the case of hollow MNs, liquid formulations are injected into the skin ("poke and flow" approach).



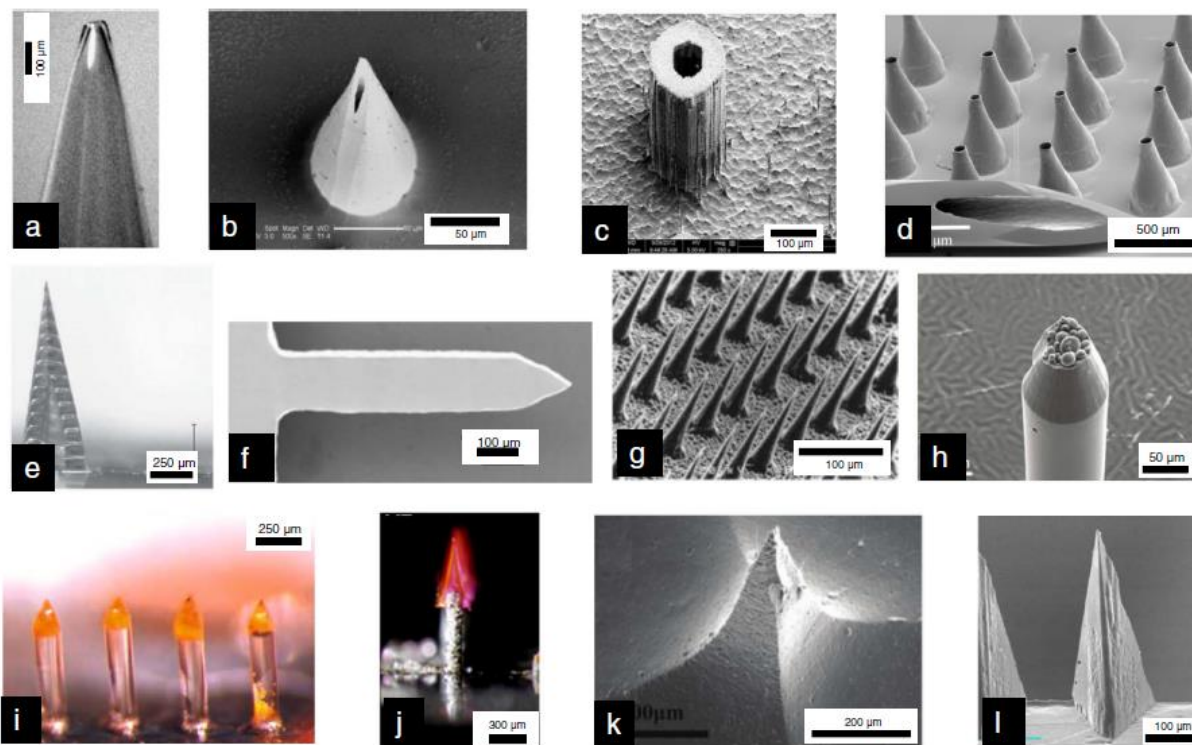


Fig. 6. Different MN designs. (a) Hollow bevel tip borosilicate glass MN [53]; (b) Hollow MN fabricated using SU-8 photoresist polymer [61]; (c) Hollow MN fabricated using silicon [62]; (d) Nickel MNs against a conventional 27G hypodermic needle tip [63]; (e) Silicon MN for potentiometric  $K^+$  determination in interstitial fluid [64]; (f) Single solid stainless steel needle [65]; (g) Sharp tapered silicon solid MNs [6]; (h) SEM image showing loaded PLA microspheres at the tip of PLGA [66]; (i) Bevel calcein loaded PLGA MNs [66]; (j) Dissolvable PVA/PVP MNs encapsulating sulforhodamine as separable arrowhead MN over a metal shaft [67]; (k) SEM image of MNs prepared using silk [68]; (l) MNs prepared using maltose [69]. Images reprinted with permission from respective publishers.



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## Wound healing potential of antibacterial microneedles loaded with green tea extracts



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Seung Hyun Han<sup>d</sup>, Jeong Gyu Lee<sup>d</sup>, Saehee Choi<sup>e</sup>, Nam Su Heo<sup>f</sup>, Dong Lak Kim<sup>a</sup>,  
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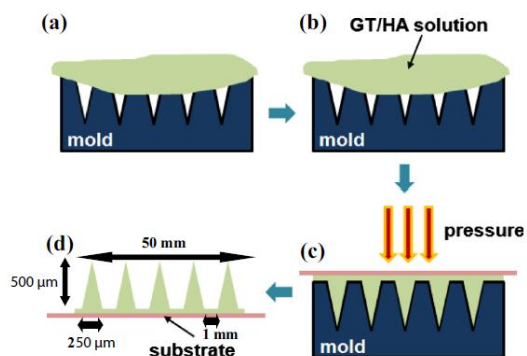


Fig. 1. Illustration of the fabrication process for biodegradable microneedles. (a) preparation of press mold, (b) cover of green tea extract and hyaluronic acid (GT/HA) solution, (c) filling of GT/HA solution in the cavities of press mold using master structure, and (d) GT/HA microneedles peeled from the master structures.

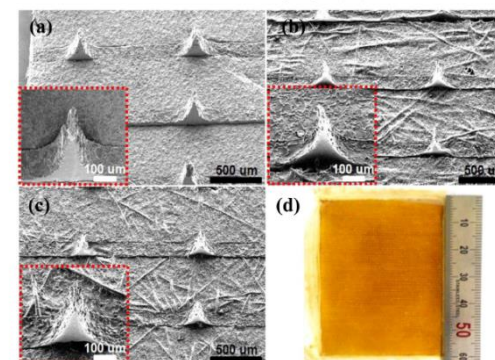
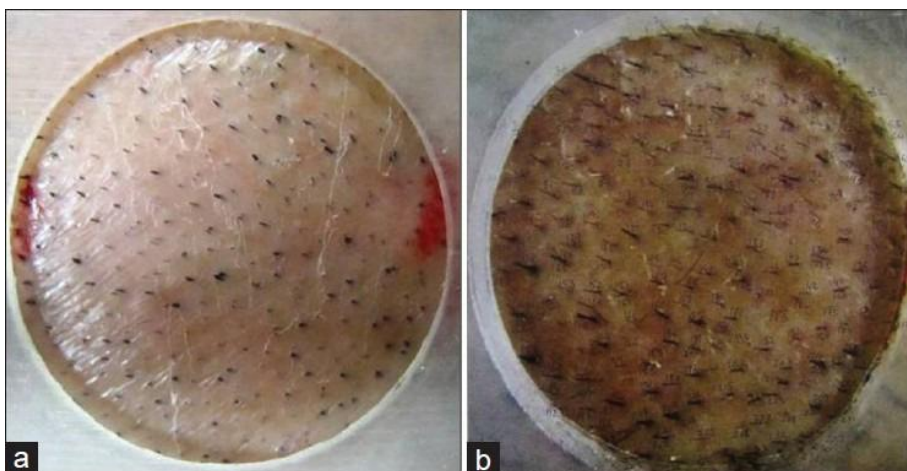


Fig. 2. SEM of (a) HA (GT 0%, HA 100%), (b) GT30 (GT 30%, HA 70%), (c) GT70 (GT 70%, HA 30%), and (d) optical image of GT70 microneedles.





Needling als Tool für eine bessere Wirkung von topisch applizierten  
Medikamenten z.B. topisch appliziertes Vitamin A und C,...  
oder transdermale Aufnahme von 5% Minoxidil („4x verbesserte Wirkung“)



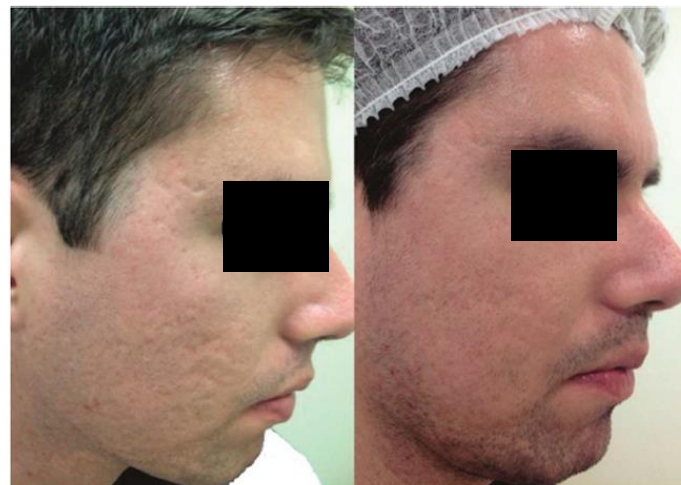
Dhurat R1, Sukesh M, Avhad G, Dandale A, Pal A, Pund P. A randomized evaluator blinded study of effect of microneedling in androgenetic alopecia: a pilot study. *Int J Trichology*. 2013 Jan;5(1):6-11. doi: 10.4103/0974-7753.114700.

Lee YB, Eun YS, Lee JH, Cheon MS, Park YG, Cho BK, Park HJ. Effects of topical application of growth factors followed by microneedle therapy in women with female pattern hair loss: a pilot study. *J Dermatol*. 2013 Jan;40(1):81-3. doi: 10.1111/j.1346-8138.2012.01680.x. Epub 2012 Oct 5.



## Comparison of Nonablative Fractional Erbium Laser 1,340 nm and Microneedling for the Treatment of Atrophic Acne Scars: A Randomized Clinical Trial

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GABRIELA MALDONADO, MD, ScM,<sup>†</sup> TANIA CESTARI, MD, PhD,<sup>†</sup> AND OLY CORLETA, MD, PhD<sup>§</sup>



## Assessment of the Combined Efficacy of Needling and the Use of Silicone Gel in the Treatment of C-Section and Other Surgical Hypertrophic Scars and Keloids

Gabriella Fabbrocini, Prof MD; Claudio Marasca, MD; Sadia Ammad, MD; Benedetta Brazzini, MD;  
Rosanna Izzo, MD; Marianna Donnarumma, MD; and Giuseppe Monfrecola, Prof MD





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International Journal of Women's Dermatology



## Skin needling as a treatment for acne scarring: An up-to-date review of the literature<sup>☆</sup>

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**Conclusion:** There is moderate evidence to suggest that skin needling is beneficial and safe for the treatment of acne scarring. However, double-blinded, randomized controlled trials are required to make more definitive conclusions.







**Fig. 4.** Effects of MN treatment against acne, skin wrinkles and androgenic alopecia. Patients before (upper panel) and after treatment (lower panel) with fractional radiofrequency microneedling (a, c) [47,48], a combination of MN and 35% glycolic acid peel (b) [35]; combination of MN fractional radiofrequency, fractional skin resurfacing, and non-ablative radiofrequency skin tightening (d) [41], and microneedling with dermaroller in combination with topical minoxidil (e, f) [42]. Images reprinted with permission from respective publishers.







BURNS 43 (2017) 1097–1102



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## Percutaneous collagen induction as an additive treatment for scar formation following thermal injuries: Preliminary experience in 47 children

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BURNS 40 (2014) 966–973



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## Microneedling: Matching the results of medical needling and repetitive treatments to maximize potential for skin regeneration

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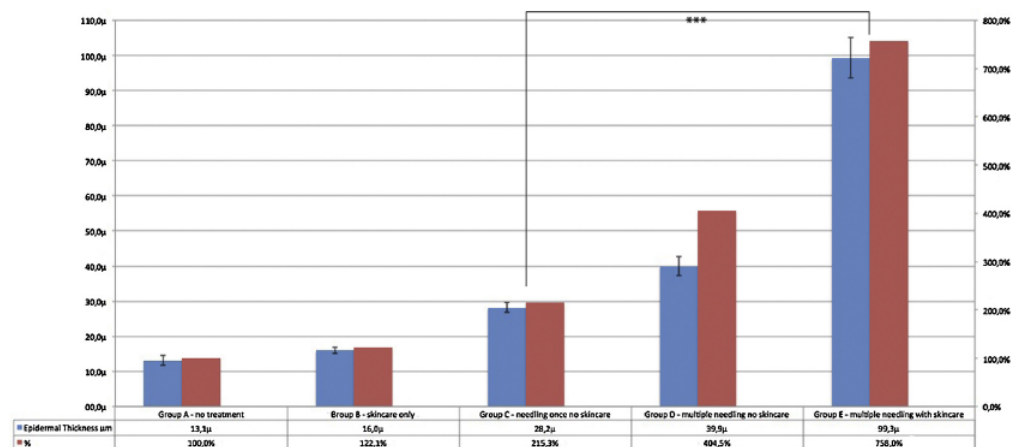


Fig. 1 – Presented here are the different groups and the growth in epidermal thickness they achieved. It is clear to see the increase in growth with repetitive treatments superceeding the singular treatment. The highest increase could be observed in the group with four repetitive sessions of microneedling in addition to topical Vitamin A and C. \*\*\*  $p < 0.05$  in Dunn post-hoc test.

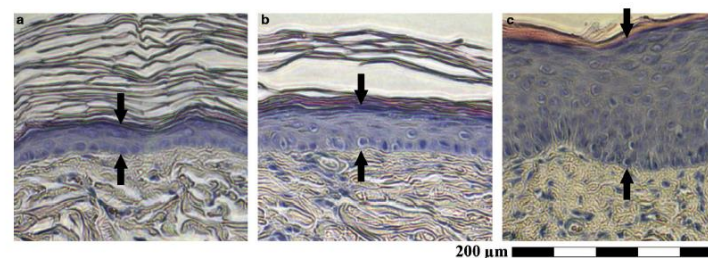
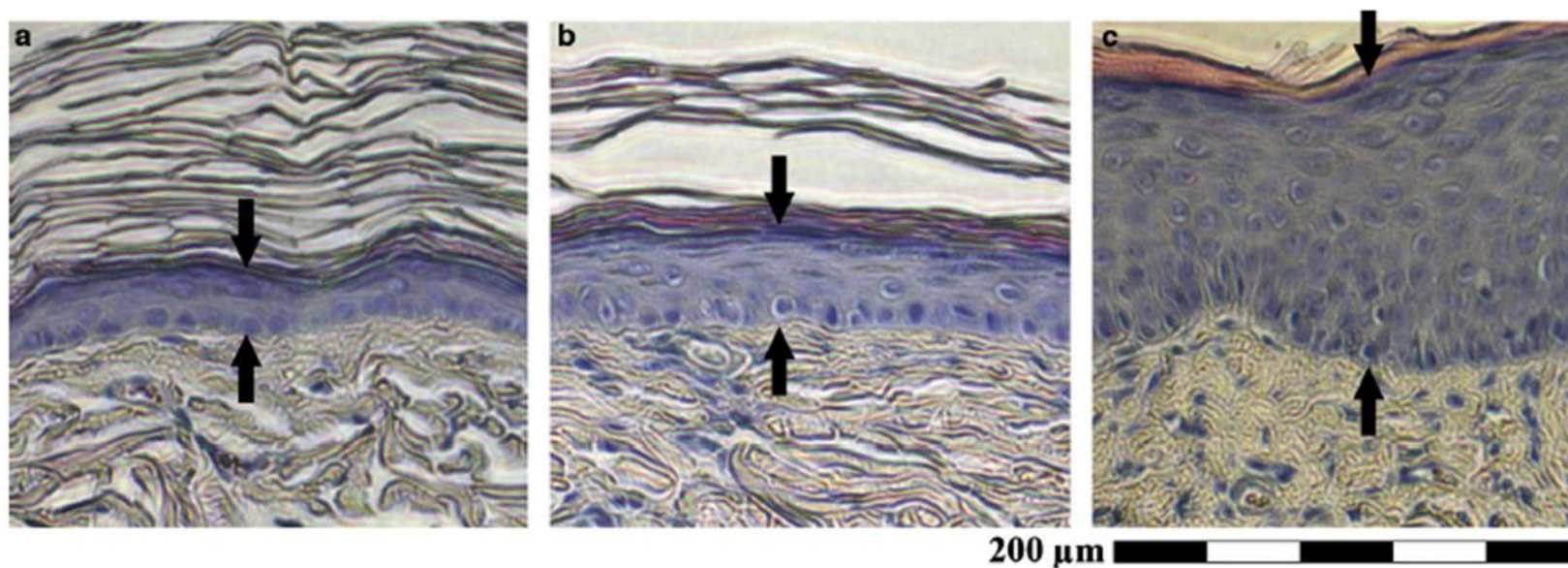


Fig. 2 – Microphotographs taken of representative skin samples stained with hematoxylin-eosin (exemplary shown) presenting the epidermal thickness. (a) Once needled animal without skin-care—represents group C. (b) Four-times needled animal without skincare—represents group D. (c) Four-times needled animal with topical retinyl-palmitate and ascorbyl tetra-isopalmitate—represents group E. All microphotographs share the same scale of 200 µm. (c) The increase in thickness of the epidermis with repetitive treatments in addition to the topical retinyl-palmitate and ascorbyl tetra-isopalmitate show how effective these combined techniques are. Furthermore it can be seen, that the stratum corneum is much more compacted in the repetitive needled animals (b) and (c).





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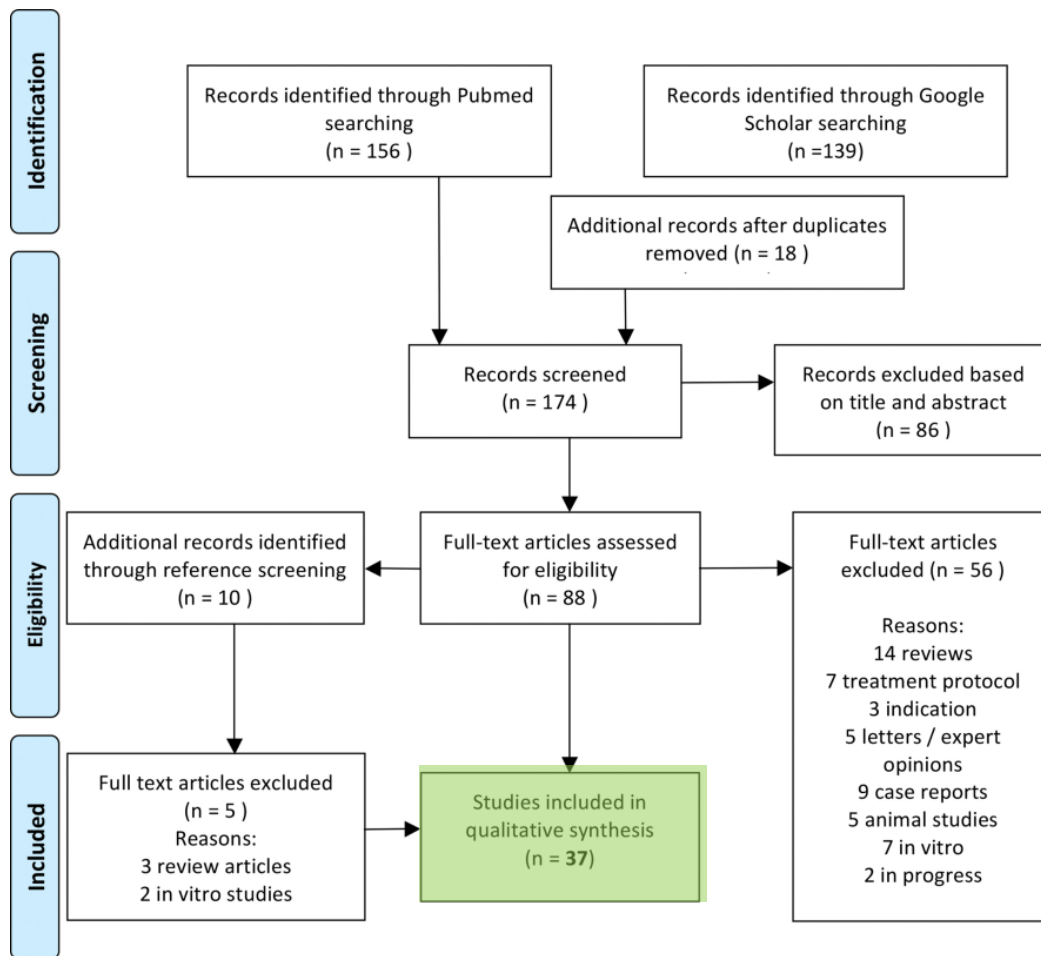






Table 2 Methods.

	Participants	Dropouts	Intervention	Comparison	Efficacy measurement			No. of treatments	Follow-up
					Cat	Num	Histo		
<b>Acne vulgaris</b>									
CT									
Kim et al.	25	0	FMRF	baseline	x	x		3	12
Lee et al.	20	0	FMRF	baseline	x	x		1	8
<b>Androgenetic alopecia</b>									
RCT									
Dhurat et al.	100	6	MN + minoxidil	MN	x	x		12	12
CT									
Dhurat et al.	4	0	MN + minoxidil	baseline	x			12	72
<b>Atrophic acne scars</b>									
RCT									
Alam et al.	20	5	MN	negative control	x			3	24
Chae et al.	40	0	FMRF	fractional laser (1550 nm)	x			3	20
Cachafeiro et al.	46	4	MN	fractional laser (1340 nm)	x			3	24
Lehata et al.	39	1	MN + TCA	fractional laser	x			6	48
Lehata et al.	30	3	MN	TCA-CROSS	x			4	4
Lehata et al.	24	4	MN + TCA	TCA-CROSS	x			4	32
Min et al.	23	3	FMRF	bipolar RF	x	x	x	2	8
Nofal et al.	45	0	MN + PRP	TCA-CROSS intradermal PRP	x			3	2
CCT									
Asif et al.	50	0	MN + PRP	MN + distilled water	x			3	12
Chawla et al.	30	3	MN + PRP	MN + vC	x			4	1
Fabroccini et al.	12	0	MN	MN + PRP	x			2	32
Jaishree S et al.	30	0	MN	MN + GA peel	x			5	12
Puri et al.	30	0	MN	TCA-CROSS	x			4	16
CT									
Dogra et al.	36	6	MN	baseline	x			5	4
El-Domyati et al.	10	0	MN	baseline	x		x	6	2
Fabroccini et al.	60	0	MN	baseline	x	x		3	40
Fabroccini et al.	32	0	MN	baseline	x	x		2	8
Imrad Majid	37	1	MN	baseline	x			4	8
Lotfi et al.	30	0	MN	baseline	x		x	5	8
Kaftan et al.	25	0	MN	baseline	x			2	4
<b>Burn scars</b>									
RCT									
Busch et al.	20	1	MN + NCASCS	MN, neg co	x	x		1	48
CT									
Aust et al.	16	0	MN	baseline	x		x	4	48
<b>Hypertrophic scars and keloids</b>									
RCT									
Fabroccini et al.	20	0	MN + Silil Gel	MN alone, SG alone	x	x		3	12
<b>Melasma</b>									
RCT									
Budamakuntla et al.	60	8	MN + TA	injection TA	x			3	12
CCT									
Fabroccini et al.	20	0	MN + depigmn serum	serum	x	x		2	12
<b>Skin rejuvenation</b>									
RCT									
Lee et al.	25	0	MN + hESC-EPC	MN	x	x		5	2

Table 2 (continued)

	Participants	Dropouts	Intervention	Comparison	Efficacy measurement			No. of treatments	Follow-up
					Cat	Num	Histo		
CT									
El-Domyati et al.	10	0	MN	baseline	x		x	6	2
Fabroccini et al.	10	0	MN	Baseline	x	x			
Fabroccini et al.	8	0	MN	Baseline	x	x		2	32
Gold et al.	49	4	FMRF	Baseline	x			3	12
Kim et al.	11	0	FMRF	Baseline	x			3	12
<b>Striae</b>									
CCT									
Khater et al.	20	0	MN	Fractional laser (CO <sub>2</sub> )	x		x	3	24
CT									
Park et al.	16	0	MN	baseline	x		x	3	12
Total	1083	49			39	12	7	139	
Mean	29,2702	1,5312						3,86111	17,8055

Akne Narben  
Alopezie  
Narben (Verbrennung)  
Hypertrophe Narben, Keloide  
Pigmentflecke  
Skin Rejuvenation  
Striae







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