

Modulation of hair growth by topical drug delivery enhanced by STAR particles

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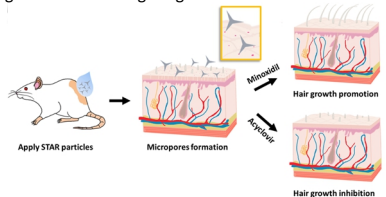
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PURPOSE

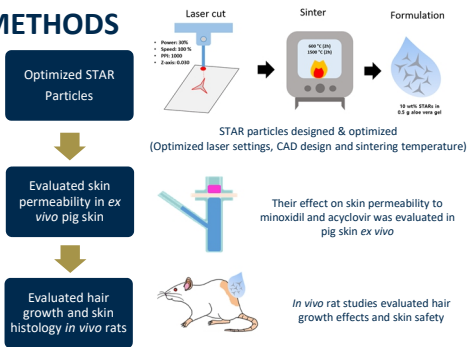
In this study, we studied the use of STAR particles, which are millimeter-sized ceramic particles with protruding microneedles, to form micropores in the skin to increase skin permeability to hair growth-modulating drugs.



OBJECTIVES

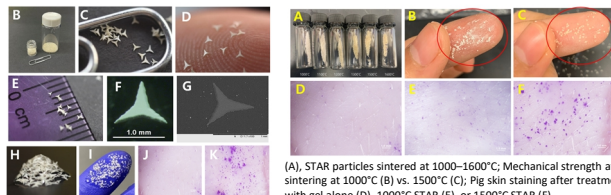
- STAR particles rubbed on skin formed micropores in stratum corneum.
- STAR particle treatment increased skin permeability to hair growth-modulating drug.
- STAR particle treatment modulated hair growth in rats *in vivo*.

METHODS



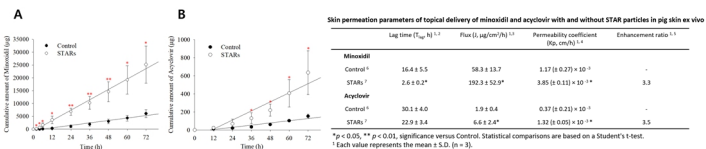
RESULTS

Optimization of STAR Particles



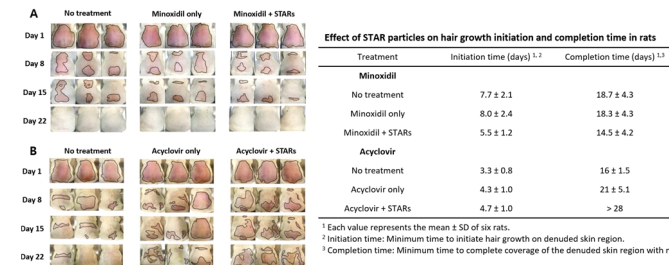
(A), STAR particles sintered at 1000–1600°C. Mechanical strength after sintering at 1000°C (B) vs. 1500°C (C). Pig skin staining after treatment with gel alone (D), 1000°C STAR (E), or 1500°C STAR (F)

Enhanced skin permeability of Minoxidil and Acyclovir in ex vivo pig Skin

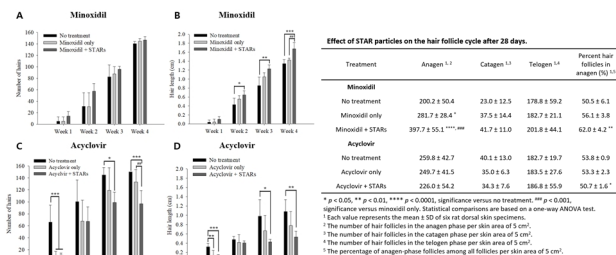


(A), minoxidil and (B), acyclovir. Data were collected in pig skin ex vivo on an area of 1.77 cm² and show mean \pm standard deviation (n = 3). * $p < 0.05$, ** $p < 0.01$, significance versus Control. Statistical comparisons are based on a Student's *t*-test.

Enhanced topical delivery and hair growth modulation in rats



Effect of STAR particles on hair characteristics and hair Follicle Cycling



CONCLUSIONS

- STAR particles were engineered to produce micropores in the stratum corneum.
- They reduced lag time and enhanced skin permeability to minoxidil and acyclovir in pig skin *ex vivo*.
- In vivo* rat studies showed improved delivery, hair growth modulation, and no visible skin irritation.
- STAR particles enable better topical delivery and control of hair growth.

REFERENCES

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