Abstracts of Outstanding Presentation (3)

The Effects of Roxithromycin and Minocycline on Melanin Synthesis

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Introduction

Both roxithromycin and minocycline have been used to treat acne vulgaris. However, minocycline occasionally causes cutaneous hyperpigmentation. We examined the effects of roxithromycin and minocycline on melanogenesis in cultured human melanoma cells and keratinocytes.

Materials and Methods

Roxithromycin and minocycline at doses of 10 and 30 μg/mL were added for 5 days to cultured HMEKO human melanoma cells. Cell number, melanin content, the activities of the enzymes tyrosine hydroxylase and DOPAchrome tautomerase, and the amounts of tyrosinase and of tyrosinase-related protein (TRP)-1 and -2 were examined. Roxithromycin and minocycline were added to cultured human keratinocytes at doses of 10 μg/mL for 0.5 and 24 hours, and then ultraviolet B (UVB) irradiation was applied at 25 mJ/cm². After another 15 hours of incubation, RNA was extracted, and the reverse-transcriptase polymerase chain reaction was performed to evaluate the messenger (m) RNA expression of pro-opiomelanocortin (POMC) and endothelin (ET) 1.

Results

Roxithromycin inhibited cell growth 43.6% at a dose of 30 μg/mL but did not significantly inhibit cell growth at a dose of 10 μg/mL. Minocycline at doses of 10 and 30 μg/mL inhibited cell growth by 25.3% and 31.8%, respectively. Roxithromycin inhibited melanin synthesis; in contrast, minocycline increased melanin synthesis dose-dependently.

Roxithromycin at a dose of 30 μg/mL significantly inhibited tyrosine hydroxylase activity; however, minocycline at a dose of 30 μg/m increased tyrosine hydroxylase activity. An in vitro tyrosinase assay using human crude tyrosinase extracted from the melanosome fraction of HMEKO cells showed that neither roxithromycin nor minocycline directly inhibited tyrosinase. Furthermore, DOPAchrome tautomerase activity was not affected by roxithromycin or minocycline at any dose.

Western blotting showed that roxithromycin did not induce any significant changes in the expression of tyrosinase, TRP-1, or TRP-2. Minocycline increased the expression of glycosylated tyrosinase but did not affect the expression of TRP-1 or TRP-2.

The addition of roxithromycin to keratinocytes did not affect the mRNA expression of POMC or ET-1. However, minocycline increased the mRNA expression of POMC but not that of ET-1. UVB irradiation increased POMC expression, which was also synergistically increased by minocycline.
Discussion and Conclusion

Both melanocytes and keratinocytes determine skin color. Our in vitro study using melanoma cells and keratinocytes showed that minocycline increases pigmentation via the induction of POMC synergistically with UVB irradiation as well as direct activation of tyrosinase. On the other hand, roxithromycin activity inhibited tyrosine hydroxylase. The schematic summary is shown in Figure 1. Our results suggest that avoidance of UVB exposure is necessary to prevent skin hyperpigmentation during the usage of minocycline.