Application of in vivo imaging in laser treatment for facial hyperpigmentation

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The diagnosis of skin disorders depends on the morphological information beneath the skin surface. Noninvasive optical virtual skin biopsy provides an ideal technology to study facial hyperpigmentation. Harmonic generation microscopy (HGM) uses virtual-transition-based nonlinear optical mechanism, and has submicron resolution, adequate penetration and good contrast between the epidermis and dermis. Several morphological parameters of HGM imaging relevant to melanin, including melanin mass density of basal cells ($MMD_{basal\ cell}$), Epidermal melanocyte dendricity score (EMDS) and dermal melanin index (DMI), were obtained by HGM. The parameters can be applied for evaluating pigmentary disorders including solar lentigo, Hori's nevus, and melasma. In addition, longitudinal tracking of the same skin lesion renders the noninvasive, real-time imaging techniques preferable for evaluation the treatment efficacy of lasers and the occurrence of post-inflammatory hyperpigmentation. Active melanocytes with increased cellular dendricity and pigment incontinence presenting as increased numbers of melanophages or free melanin in the dermis can be found after laser treatment. In conclusion, HGM can be used clinically for facial hyperpigmentary disorders to obtain real-time imaging with high resolution, and importantly, without causing photodamage on the skin.