Multiple miliary osteoma cutis treatment response to Q-switched Nd:YAG laser: A case report

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Abstract
Facial multiple miliary osteoma cutis is a variant of osteoma cutis usually occurring in women with a previous history of acne vulgaris. Successful ablative laser treatment has been reported using both CO2 and Er:YAG lasers among other invasive treatment modalities, like surgical removal. We report a patient with biopsy-proven facial multiple miliary osteoma cutis responding to non-ablative Q-switched Nd:YAG laser therapy. The patient had excellent cosmesis without textural changes or hypopigmentation despite her Asian background after three sessions over 6 months. Multiple miliary osteoma cutis is therefore now amenable to non-surgical non-ablative therapy by using Q-switched Nd:YAG laser therapy reducing the risk of textural changes and hypopigmentation, especially in dark complexion and high-risk individuals. To our knowledge, this treatment approach has not been previously reported.

Keywords
Osteoma cutis, bone, acne, skin, laser, therapy, Nd:YAG, non-ablative

Introduction
Osteoma cutis (OC) is collectively defined as heterotopic foci of bone tissue in the dermis and subcutaneous tissue.1 This condition is divided into two forms; a rare primary form with \textit{de novo} lesions arising on healthy skin and the more common secondary form in which a metaplastic ossification occurs on pre-existing lesions (inflammatory, neoplastic, metabolic, traumatic or iatrogenic).2 In 1864, Virchow described an ambiguous variant of OC called multiple miliary osteoma cutis (MMOC), encompassing both forms but most often reported as the secondary form consecutive to acne lesions.1,3 It has been claimed that MMOC mostly affects women with a history of acne even though this is primarily based on case reports and a few case series.1 Based on the available literature, middle age, female gender, a history of acne, and white skin are risk factors. An association with ultraviolet exposure and sun-seeking behaviours is hypothesized. The facial skin is almost always affected (>90%), and extra-facial involvement is more common in men. Patients using tetracycline or minocycline may present with bluish lesions.4

MMOC is now considered a relatively common, but often under-recognized condition. Past and recent imaging studies found incidental skin osteomas and calcified nodules of the face ranging from 27.8% to 42.1% in routine X-ray and computed tomography (CT) scan analysis, respectively.5,6 MMOC is then seemingly under-diagnosed with mostly subclinical lesions passing under the radar during clinical examination leading to only obvious cases of aesthetically conscious patients consulting for such condition. Misdiagnosis and the benign behaviour of the condition may also contribute to under-reporting.1

So far, MMOC treatment modalities favour the simple ‘incision and curettage’ technique, but successful ablative laser procedures have also been reported.7,8 However, ablative laser procedures using CO2 and Erbium:YAG lasers may lead to permanent pigmentary changes like hypopigmentation9. Instead, to avoid such risk, we decided to perform non-ablative Q-switched Nd:YAG laser treatments on a dark complexion patient with biopsy-proven facial MMOC and obtained promising results. To our knowledge, this treatment approach has not been previously reported. Q-switched Nd:YAG laser may then become an alternative...
Case history

A 56-year-old healthy Asian woman was referred by a dermatologist with biopsy-proven osteoma cutis located on her cheeks for at least 3 years. Physical examination showed numerous red-brown, recalcitrant, 1–3 mm papular lesions on both cheeks (Figure 1(a)). She also exhibited uneven facial hyperpigmentation (dyspigmentation) frequently present with phototype IV Asian individuals. Her medical history was unremarkable with no prior acne and only Vitamin D intake.

A skin biopsy specimen was obtained from one of the indurated papules (Figure 2) confirming the diagnosis of MMOC of the face based on clinical and histopathological results. To avoid additional dyspigmentation secondary to ablative procedures using CO₂ and Erbium:YAG lasers, the affected areas were treated three times with a non-ablative Q-switched Nd:YAG laser at 1064 nm (VRM, Lutronics, Seoul, Korea). Treatment parameters were the following: 1064 nm, spot size 4 mm, fluence 8 J/cm² and repetition rate 5 Hz and blanching/pinpoint bleeding was the tissue endpoint. Treatment intervals between laser sessions were 2 and 3 months, respectively.

Wound care included the application of topical antibiotic cream to the treated areas for 7 days to prevent infection.

At the 8-month follow-up visit post-third session, excellent cosmesis was observed for the treated lesions (Figure 1(b)), and the patient was very satisfied with the clinical results.

treatment modality, especially for higher Fitzpatrick phototypes (III-IV-V) to reduce side effects like post-treatment dyspigmentation.

Figure 1. (a) Phototype IV patient with dyspigmentation showing numerous red-brown 1–3 mm papular lesions on the left cheek before treatment. (b) Noticeable improvement of the papular component at 8 months following the third QS-Nd:YAG laser treatment. A mild residual dyspigmentation persists.

Figure 2. Histopathology (x40) of osteoma cutis. Bone formation is identified by osteocytes held within small lacunae and the hydroxyapatite eosinophilic support material.
Discussion

In this case, the spontaneous appearance of the lesions without any evidence of associated skin conditions such as inflammation suggested primary cutaneous ossification. The pathogenesis of MMOC is not well described. The most acknowledged hypothesis is fibroblast metaplasia. In situ hybridization technique showed that dermal fibroblasts can differentiate into osteoblasts leading to increased collagen type I and osteonectin production. Another hypothesis supported by available data is that primitive mesenchymal cells differentiate normally into osteoblasts but migrate to an aberrant location. Gene mutation may also be involved in syndromes of skin ossification.

Treatment modalities for primary MMOC of the face are limited. Non-invasive treatment, such as the application of tretinoin cream, can be used with limited success mainly when the lesions are small and superficial. Invasive treatments such as a combination of dermabrasion and punch biopsy, scalpel incisions and curettage, erbium:yttrium-aluminum-garnet (YAG) laser and CO2 laser were investigated in previous studies for managing MMOC. Unfortunately, they frequently leave unacceptable pigmented changes post-treatment (hyper and/or hypopigmentation), especially in dark complexion patients.

The use of the Q-switched Nd:YAG laser was initially described 30 years ago by Anderson et al. for cutaneous pigmentation using a principle called selective photothermolysis, in which melanosomes and pigmented cells are preferentially targeted. Another study using this laser demonstrates improvement of atrophic acne scars where neocollagenesis is triggered by selective delivery of thermal energy to the dermis, inducing a controlled wound healing response without epidermal damage. Since calcium/bone (osteoma) does not absorb laser energy at 1064 nm, the proposed mechanism of action may be similar. This suggests water as the primary chromophore inducing a dermal inside-out heating. Moreover, the photoacoustic effect triggered by the pocket cell (in the nanosecond domain) of this Q-switched technology, can create intradermal cavitation in and around the targeted structure. Such mega-pulse of light energy may then, in turn, destroy/implode even bone structures (osteoma cutis) in the dermis followed by a wound healing response without epidermal damage, reducing the risk of pigmented changes in darker phenotype individuals.

Nevertheless, although clinical results are promising, this case report has some limitations associated with a retrospective and uncontrolled study. Therefore, optimized prospective studies with more patients are needed. Furthermore, a prospective split-face study comparing ablative fractional resurfacing (CO2 laser) to the non-ablative Q-switched Nd: YAG laser presented in the case report, would be indicated to show its superiority.

In our opinion, non-ablative Q-switched Nd: YAG laser represents an important alternative treatment approach to consider, especially when treating dark complexion dyspigmentation-prone MMOC patients.

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Informed consent

The patient provided consent for publication of the case report.

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