Topical application of NADH for the treatment of rosacea and contact dermatitis

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Summary

Among many important physiological functions played by NADH (the reduced form of β-nicotinamide adenine dinucleotide) its antioxidative properties are remarkable. Acting directly as an antioxidant, NADH can effectively protect the cell and its membrane from destruction by free radicals. NADH can be stabilized as a suspension in hydrophobic ointments prepared in a way that prevents contact with atmosphere containing oxygen and water. We present the first report of NADH as a treatment for some inflammatory dermatoses. It was found that topical application of 1% NADH diluted in Vaseline ointment can be very effective in the treatment of rosacea and contact dermatitis. Since no adverse effects were observed, therapy with NADH can be viewed as a potential alternative to other established treatments.

Introduction

NADH (the reduced form of β-nicotinamide adenine dinucleotide) is an essential coenzyme in several metabolic pathways. Among many physiological functions played by this compound, its antioxidative properties are especially important. NADH has the highest reducing power of any biological material, higher than well-known antioxidants such as vitamins C and E. Acting directly as an operating antioxidant, NADH can effectively protect the cell and its membrane from destruction by free radicals, which are involved in the development of many diseases, for example cancer, arteriosclerosis, Parkinson’s and Alzheimer’s diseases, and other autoimmune diseases. Free radicals are also expected to play a role in skin diseases with an inflammatory background.

For many years NADH has not been considered for therapeutic use because this compound is rather unstable, especially in acid solutions and undergoes general acid catalysed hydration reactions. Mechanistic aspects concerning the oxidation of NADH to NAD⁺ (the oxidized form of the coenzyme) have been studied in our laboratories. It has been found that in one-electron oxidation conditions (oxidation with molecular oxygen) primarily generated NADH radical cations can undergo further oxidation to finally form NAD⁺.

Recently, Birkmayer claimed that, if properly stabilized in the form of a pill, NADH can be shelf-stable for several months and can also survive an acidic stomach environment.

Birkmayer and coworkers also demonstrated beneficial clinical effects of NADH in the treatment of various diseases. All of these treatments concerned oral or parenteral application of NADH. No studies on the topical use of NADH in dermatology have been reported.

We now describe the first application of topical NADH for treatment of rosacea and contact dermatitis.

Methods

An ointment prepared under dry nitrogen atmosphere from carefully dried sample of NADH in a hydrophobic base (Vaseline, Plastibase, silicon oil, liquid paraffin or mixtures thereof) and which was found to be stable for more than a year if stored at temperatures of 5–6 °C, was used in this study.
Results

Ten women aged between 21 and 61 years with progressive rosacea were enrolled for the study. Erythema, telangiectases, papules and few pustules were present on the central part of the face in each subject. The disease had persisted from 1 to 4 years with periodic exacerbation and improvement.

The initial 3-day therapy resulted in a decrease in patients’ complaints, i.e. irritation and skin burning in six out of 10 patients. After 2 weeks, in three patients a great improvement was observed where more than 75% of papules were markedly or completely flattened and erythema was much less intense (Fig. 1).

Moderate improvement (flattening of about 50% of papules and a decrease in erythema) was noticed in five other patients. In one case only a slight improvement was observed with reduced irritation, less intense erythema but persisting papules. In one case, no clinical improvement was observed.

Nine patients (four males and five females) between 20 and 48 years with acute and short-lasting exogenous eczema as a form of allergic contact dermatitis (clinical diagnosis) or irritant dermatitis were treated for 14 days. The lesions were triggered by external environmental factors, characterized by erythema, swelling, vesiculation and pruritus without clinical symptoms of bacterial infection. Skin eruptions were single or multiple, usually located on the upper limbs or face. In all patients the history of atopy was negative. Skin eruptions were not treated before NADH application.

Observations made for this group of patients demonstrated initially a disappearance of pruritus, usually after 2 days. After 14 days of treatment erythema, oedema and vesicular lesions decreased markedly in six patients and completely in other three patients. No skin dryness or post-inflammatory desquamation was noticed. An example of therapeutic progress is shown in Fig. 2.

It should be emphasized that the two groups of patients diagnosed with rosacea or contact dermatitis were treated exclusively with NADH ointment (2–3 g, depending on the area of affected skin) applied twice daily.

![Figure 1](image1.png)  
**Figure 1** Treatment of rosacea with NADH ointment in a 61-year-old-woman. (a) Before treatment. (b) After 14 days of treatment.

![Figure 2](image2.png)  
**Figure 2** Treatment of contact dermatitis with NADH ointment in a 40-year-old man. (a) Before treatment. (b) After 14 days of treatment.
Discussion

The therapeutic properties of NADH demonstrated in this pilot study may arise through multiple mechanisms. NADH, known as an ‘energizing’ physiological molecule, can improve metabolism of skin cells. Also its profound antioxidant properties can attenuate the damaging effects of free radicals associated with developed inflammation.

The aim of this research was to demonstrate the feasibility of applying NADH topically as a treatment for inflammatory skin diseases. It is clear that the demonstrated therapeutic potential associated with the observed lack of any adverse or undesirable side effects points towards NADH as a safe alternative to conventional treatment. Further double-blind studies are needed to evaluate NADH application in the treatment of skin diseases.

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References