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Effects of ozone therapy on facial nerve regeneration[☆]

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KEYWORDS

Ozone;
Regeneration;
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Abstract

Introduction: Ozone may promote moderate oxidative stress, which increases antioxidant endogenous systems. There are a number of antioxidants that have been investigated therapeutically for improving peripheral nerve regeneration. However, no previous studies have reported the effect of ozone therapy on facial nerve regeneration.

Objective: We aimed to evaluate the effect of ozone therapy on facial nerve regeneration.

Methods: Fourteen Wistar albino rats were randomly divided into two groups with experimental nerve crush injuries: a control group, which received saline treatment post-crush, and an experimental group, which received ozone treatment. All animals underwent surgery in which the left facial nerve was exposed and crushed. Treatment with saline or ozone began on the day of the nerve crush. Left facial nerve stimulation thresholds were measured before crush, immediately after crush, and after 30 days. After measuring nerve stimulation thresholds at 30 days post-injury, the crushed facial nerve was excised. All specimens were studied using light and electron microscopy.

Results: Post-crushing, the ozone-treated group had lower stimulation thresholds than the saline group. Although this did not achieve statistical significance, it is indicative of greater functional improvement in the ozone group. Significant differences were found in vascular congestion, macrovacuolization, and myelin thickness between the ozone and control groups. Significant differences were also found in axonal degeneration and myelin ultrastructure between the two groups.

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PALAVRAS-CHAVE

Ozônio;
Regeneração;
Nervo facial

Conclusions: We found that ozone therapy exerted beneficial effect on the regeneration of crushed facial nerves in rats.

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Efeitos da terapia com ozônio na regeneração do nervo facial**Resumo**

Introdução: O ozônio pode promover estresse oxidativo moderado, o que aumenta sistemas endógenos antioxidantes. Há determinado número de antioxidantes sendo investigados terapêuticamente para melhorar a regeneração do nervo periférico. No entanto, nenhum estudo anterior relatou o efeito da terapia com ozônio na regeneração do nervo facial.

Objetivo: Nosso objetivo foi avaliar o efeito da terapia com ozônio na regeneração do nervo facial.

Método: Ao todo, 14 ratos albinos Wistar foram divididos aleatoriamente em dois grupos com lesões experimentais por esmagamento do nervo: um grupo controle, que recebeu tratamento com solução salina pós-esmagamento; e um grupo experimental, que recebeu tratamento com ozônio. Todos os animais foram submetidos a cirurgia na qual o nervo facial esquerdo foi exposto e esmagado. O tratamento com solução salina ou ozônio se iniciou no dia do esmagamento do nervo. Os limiares de estimulação do nervo facial esquerdo foram medidos antes do esmagamento, imediatamente após o esmagamento e após 30 dias. Depois de medir limiares de estimulação do nervo aos 30 dias pós-lesão, o nervo facial esmagado foi excisado. Todas as amostras foram estudadas por meio de microscopia óptica e eletrônica.

Resultados: Após o esmagamento, o grupo tratado com ozônio apresentou menores limiares de estimulação do que o grupo da solução salina. Embora isto não tenha significância estatística, é indicativo de maior melhora funcional no grupo do ozônio. Foram encontradas diferenças significativas na congestão vascular, macrovacuolização e espessura da mielina entre os grupos do ozônio e controle. Diferenças significativas também foram encontradas na degeneração axonal e ultraestrutura de mielina entre os dois grupos.

Conclusões: Verificou-se que a terapia com ozônio teve efeito benéfico sobre a regeneração dos nervos faciais esmagados em ratos.

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Introduction

Peripheral facial palsy is the most frequent cranial neuropathy and may arise from diverse mechanisms of injury to the seventh cranial nerve. After injury, regeneration of the facial nerve is problematic. Nerve injury, such as lipid peroxidation of neurovascular cells, can lead to oxidative stress as a result of the production of free radicals.^{1,2} Various methods have been used to enhance peripheral nerve regeneration.^{3,4} It is well known that oxygen free radicals influence nerve regeneration, and additionally, some studies have demonstrated that antioxidants reduce the levels of free oxygen radicals.^{5,6}

Ozone (O₃), a powerful oxidant, is non-persistent with a half-life of approximately 20 min at normal temperatures.⁷ It decomposes and disperses in water easily. O₃ can restrain inflammatory cell factors, activate cyclooxygenase, and decrease the stress reaction to histiocytic oxidation, augmenting the histiocytic ability of resisting oxidation and free radicals.⁷ It can also scavenge the free radicals resulting

from chronic inflammation, can serve as a painkiller and is anti-inflammatory.⁸

The concept of using ozone to improve the healing of infected wounds, necrotic, or poorly oxygenated tissue has been explored in orthopedics, dentistry and with skin wounds.⁹ However, no previous study has reported on the effect of ozone therapy on facial nerve regeneration. Therefore, we investigated the effect of ozone therapy on facial nerve regeneration in rats. To the best of our knowledge, this is the first study to evaluate ozone therapy in this context.

Methods**Study design**

Fourteen Wistar albino rats with a mean (SD) weight of 250–300 g were housed in groups for 7–14 days under standard environmental conditions, with free access to food and water. The rats were randomly divided into two groups

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