

## Balneotherapy in medicine and dentistry: A review

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### Abstract

Balneotherapy is the treatment of disease by bathing, usually practiced in spas. Balneotherapy may be recommended for a wide range of illnesses, including arthritis, skin conditions and fibromyalgia. Like any medical treatment, balneotherapy should be discussed with a physician before practice, as advocating it in some conditions, like heart disease and pregnancy, can result in serious adverse reactions.

**Keywords:** Balneotherapy, Medicine, Dentistry.

### Introduction

Balneotherapy (from Latin: balneum, "bath") is the treatment of disease by bathing, usually practiced in spas. Balneotherapy may involve hot or cold water, massage through moving water, relaxation or stimulation. Many a times mineral waters at spas are rich in particular minerals (sulfur, selenium, radium) which can be absorbed through the skin.

Balneotherapy may be recommended for a wide range of illnesses, including arthritis, skin conditions and fibromyalgia. Like any medical treatment, balneotherapy should be discussed with a physician before practice, as advocating it in some conditions, like heart disease and pregnancy, can result in serious adverse reactions. Scientific studies into the effectiveness of balneotherapy tend to be neutral or positive, finding that balneotherapy provides no effect or a placebo effect, or that there is a positive effect. However, many of these studies suffer from methodological flaws, and so may not be entirely reliable. As the warmth of the water cradles the physical body, providing relief from the constant pull of gravity, the psyche is refreshed and restored.

Seven ways by which balneotherapy heals:

1. Bathing in hot springs gradually increases the temperature of the body, thus killing harmful germs and viruses.
2. It increases hydrostatic pressure on the body, thus increasing blood circulation and cell oxygenation. The increase in blood flow also helps dissolve and eliminate toxins from the body.
3. Hot springs bathing increases the flow of oxygen-rich blood throughout the body, bringing improved nourishment to vital organs and tissues.
4. Bathing in thermal water increases body metabolism, including stimulating the secretions of the intestinal tract and the liver, aiding digestion.
5. Repeated hot springs bathing (especially over 3- to 4-week period) can help normalize the functions of the endocrine glands as well as the functioning of the body's autonomic nervous system.

6. Trace amounts of minerals such as carbon dioxide, sulfur, calcium, magnesium, and lithium are absorbed by the body and provide healing effects to various body organs and system. These healing effects can include stimulation of the immune system, leading to enhanced immunity; physical and mental relaxation; the production of endorphins; and normalized gland function.
7. Mineral springs contain high amounts of negative ions, which can help promote feelings of physical and psychological well-being.

### Mechanisms of action of balneotherapy

#### Mechanical Effects

Increased buoyancy and hydrostatic pressure during immersion in thermal mineral water cause many physiologic changes. Immersion to the suprasternal notch in mineral water (35°C) results in a cascade of reactions including increased diuresis, natriuresis, and cardiac output<sup>1</sup> (Epstein, 1992; O'Hare et al., 1985; Weston et al., 1987). The basis of these physiological effects is considered to be the hydrostatic pressure, which forces approximately 700 ml from the lower extremities to the central compartment.

#### Thermal Effects

Hot stimuli may influence muscle tone and pain intensity, helping to reduce muscle spasm and to increase the pain threshold in nerve endings. According to the "gate theory", pain relief may be due to the temperature and hydrostatic pressure of water on the skin.<sup>2</sup> Thermal stress provokes a series of neuroendocrine reactions. In particular, the heat stimulates the release of adrenocorticotrophic hormone (ACTH), cortisol, prolactin and growth hormone (GH), although it does not alter the circadian rhythm of these hormones. The effect of thermal stress on the hypothalamus-pituitary-adrenal axis seems to be particularly important for the antiedemigenous and anti-inflammatory actions of corticosteroids, as well as for the frequent alteration of the axis during some Rheumatic disease. The increase in betaendorphin demonstrated to occur with various spa therapy techniques has an analgesic and anti-spastic

effect that is particularly important in patients for whom pain is the prevalent symptom.

### Chemical Effects

The chemical effects of mud-packs and thermal therapy are less clear than the physical effects. In theory, it cannot be excluded that the organic substances or minerals of water or mud, sometimes present in traces, can be absorbed through the skin and then act at a systemic level. However, experimental evidence available in this field is scarce. Shani et al. (1985) documented a significant increase in serum concentrations of bromine, rubidium, calcium and zinc in patients with psoriatic arthritis who bathed in the Dead Sea. The penetration of the solutes is presumably influenced by the length of bathing time, the temperature of the thermal water, its composition and other factors, some of which may still be unknown. Furthermore, it has been reported that the direct application of mud-pack has greater clinical effects than the application of nylon covered mud pack in patients with knee OA.<sup>3</sup>

### Immunological Effects

Since sulphur baths have been successfully used in various skin immunomediated afflictions, it has been suggested that absorption through the skin of trace elements present in mineral water and mud packs may affect the immune system. Overall, thermal stress has an immunosuppressive effect. With regard to hyperthermia a stimulatory effect of the immune response appear to prevail at a moderate increase of local skin temperature, with increase of pro-inflammatory cytokines interleukin (IL)-6 and IL-1 $\beta$ , whereas higher temperatures (40 - 41°C) apparently suppress immune functions.<sup>4</sup> A significant reduction in circulating levels of Tlymphocytes has been demonstrated in healthy volunteers treated with hyperthermal baths and in patients with respiratory and cutaneous atopy. Hyperthermia-induced T-lymphocytopenia and eosinopenia may be due to a redistribution of the cells, probably due to the increase of ACTH and cortisol provoked by thermal stress.<sup>5</sup>

### Anti-inflammatory Effects

reduction of circulating levels of Prostaglandin E2 (PGE2) and Leukotriene B4 (LTB4), important mediators of inflammation and pain, in patients suffering from fibromyalgia who undergo mud-packs or balneotherapy.<sup>6</sup> Crenotherapy also affects the synthesis of various cytokines involved in the ongoing chondrolysis and inflammation in RD; in fact a reduction in the cytokines IL-1 $\beta$  and TNF- $\alpha$  and the soluble receptors of the latter has been demonstrated following a cycle of mud-baths therapy (temperature > 41°C) in patients with Osteoarthritis.<sup>7</sup>

### Other Effects

Many other non-specific factors may also contribute to the beneficial effects observed after spa therapy in some RD, including effects on cardiovascular risk factors. The lipid normalizing effects of balneotherapy, especially with

sulphurous waters, have been reported for decades. The results of such research have documented reductions in total cholesterol, triglycerides and non-esterified cholesterol and a significant increase in HDL- cholesterol.<sup>5</sup> More recently, attention has focused on plasma homocysteine, a risk factor for coronary heart disease, congestive heart failure, systolic hypertension, artherothrombotic events, complications in diabetes mellitus, cancer and oxidative stress. A significant reduction in plasma homocysteine has been demonstrated in OA patients after a cycle of sulphurous thermal baths. Recently Oláh et al. (Oláh et al., 2010) explored changes in several cardiovascular risk factors in a group of patients suffering from degenerative musculoskeletal disorders subjected to a cycle of balneotherapy.

### Indications for Balneotherapy:

Over the several hundred years during which the science of medical balneology has developed, physicians have been able to identify the health conditions that can best be treated by healing springs. These are examples where is balneology suggested to help.

### Chronic Diseases

1. Chronic rheumatic diseases
2. Functional recovery of central and peripheral neuroparalysis
3. Metabolic diseases, especially diabetes, obesity, and gout
4. Chronic gastrointestinal diseases
5. Chronic mild respiratory diseases
6. Circulatory diseases, especially moderate or mild hypertension Peripheral circulatory diseases (affecting the hands and feet)
7. Chronic skin diseases
8. Psychosomatic and stress-related diseases
9. Autonomic nervous system dysfunction
10. Vibration disorder (a middle ear disorder affecting balance)
11. Sequela of (conditions resulting from) trauma
12. Chronic gynecological diseases

### Contraindications

If you have any illnesses or diseases, or are pregnant, consult with your physician before using spa therapy.

### Cautions

Avoid soaking in a hot spring alone, and don't use a spa if you are on heart medications or under the influence of other drugs or alcohol. Make sure not to overheat, drink plenty of cool water, and use private pools if you have a skin disease. The elderly should use extra caution.

### Balneotherapy in Medicine

Over the past decades, a re-assessment of the use of mineral water for the treatment of several diseases has taken place around the world.<sup>6</sup> Many rheumatologists and dermatologists now acknowledge the medical significance of bathing. Thousands of health resort areas have developed

around these hot springs. Spa resorts are differentiated according to their location (sea side, mountain area) and the chemical composition of their mineral water. They are also classified as being low mineralized (0.6–2 g/l), mildly mineralized (>2–10 g/l) or highly mineralized (>10 g/l). Water temperature is described as being cold (30–40°C); or hyperthermal (>40°C).<sup>7</sup> Absorption of minerals through the skin seems to be limited. The dermatological therapeutic effect would therefore appear to lie in a local interaction between the mineral water and the structure of the skin surface. The effects of spa therapy can be divided into three categories: mechanical, thermal and chemical.

### The effects of spa therapy can be divided into three categories:

1. Mechanical
2. Thermal
3. Chemical.

#### Mechanical Effects

Immersion allows the patient to mobilize joints and strengthen muscles with minimal discomfort. This hydrostatic effect is increased when the water is more concentrated. Hydrostatic pressure also causes displacement of fluids from the extremities to the trunk, thus causing hemodilution and increased diuresis. It has been shown that immersion for 1 hour increases water excretion by about 50%.<sup>8</sup>

#### Thermal Effects

The hot water causes superficial vasodilation and it has been shown to reduce vascular spasm and stasis in the nail bed and conjunctiva.<sup>9</sup> The *in vivo* proliferative response of human peripheral blood lymphocytes to phytohemagglutinin and concanavalin A was enhanced markedly when cultured at 40°C compared with the conventional temperature of 37°C.<sup>(10)</sup>

#### Chemical Effects

The solutes or additives in spa water act primarily on the skin, but there is no doubt that under certain conditions resorption of minerals is possible. The composition and physical properties of various spa waters vary. They are salty, sulfurous, bicarbonated, carbonic, radon-rich, selenium-rich, arsenical and ferruginous, etc. It is still not clear which elements are essential and what is the ideal concentration of each element in order to attain an optimal response to treatment.

#### Dermatologic Effects

Inoue et al.<sup>11</sup> reported that balneotherapy using Kusatsu hot spring water (Japan) is useful for controlling the skin symptoms of acute flares/exacerbations of refractory cases of atopic dermatitis. It is now widely accepted that patients with atopic dermatitis are prone to cutaneous *Staphylococcus aureus* (*S. aureus*) infection during phases of acute exacerbation and also an increased density of *S. aureus* is found to correlate well with the severity of skin

manifestations.<sup>12,13</sup> It has been demonstrated that *S. aureus* on the skin surface decreased in number or disappeared after Kusatsu balneotherapy.<sup>11</sup> The bactericidal activity of hot spring water was expressed by manganese and iodide ions in acidic conditions. Balneotherapy using acidic hot-spring water (Kusatsu, Japan) was shown to be useful for controlling the skin symptoms of acute flares of refractory cases of atopic dermatitis in comparison to a hot plain-water shower.<sup>13</sup> The Dead Sea is a famous place for its balneologic properties and its effects, especially on ailments of dermatologic and rheumatologic origin. The Dead Sea has a salt content of about 320 g/l, of which potassium chloride, magnesium chloride, calcium chloride and sodium chloride are the major components. The average mineral salt contents (g/l) are as follows: sodium, 5.44; potassium, 4.16; calcium, 65.28; magnesium, 15.69; chloride, 24.96; sulfate, 24.96 and carbonate, 74.24. Total concentration of salt and minerals are 32%, compared to a total concentration of 3% in the ocean.<sup>7</sup> Two studies provided evidence for the therapeutic potential of Dead Sea spa therapy for atopic dermatitis.<sup>14,15</sup> Complete clearance of lesions was recorded in 90% of 1408 patients after 4 to 6 weeks therapy at the Dead Sea area. A reduction in itching was recorded during the first week of stay at the Dead Sea area. The percentage of patients who improved during the spring and summer (91%) was higher than in the autumn (86%) and winter (74%).<sup>9</sup> Girytes et al.<sup>15</sup> reported the efficacy of Dead Sea climatotherapy for atopic dermatitis in a non-published study. The climatotherapy regimen consisted of daily sun exposure (maximum, 3–4 hours a day), bathing in Dead Sea water (20 minutes twice a day) and free application of emollients. Acute exacerbation of atopic dermatitis must first be given specific pharmacologic treatment, however, bathing can prepare the skin for the application of moisturizers. Rest and the healthy environment provided by spas can also be positive factor in healing atopic dermatitis. A prospective, double blind, controlled study<sup>16</sup> evaluated the therapeutic effect of Dead Sea salts in patients with psoriasis. Twenty-five patients with psoriasis vulgaris were randomly allocated to 2 groups treated with either Dead Sea salt baths or common salt baths. After 3 weeks of treatment, mild improvement was observed in patients treated with Dead Sea salts compared with those treated with common salts. However, saline spa water alone at Salies de Bearn in France (sodium concentration, 250 g/l; magnesium, 980 mg/l) was reported to have a minor therapeutic effect on psoriasis compared with UVB exposure in an RCT on 90 patients.<sup>17</sup> Acne vulgaris is another dermatologic disease that benefits from balneotherapy. A non-randomized clinical study of 86 patients treated for acne vulgaris in the Dead Sea area showed a significant improvement manifested by a reduced number of comedones and pustules.<sup>9</sup> Sulfur-rich spas attract special interest for their dermatologic effects. The sulfur that penetrates the skin is oxidized and evokes various physiologic responses in the skin, such as vasodilation in the microcirculation, an analgesic influence on the pain receptors, and inhibition of the immune response. Sulfur also interacts with oxygen radicals in the deeper layers of the epidermis, producing

sulfur and disulfur hydrogen, which may be transformed into pentathionic acid, and this may be the source of the antibactericidal and antifungal activity of sulfur water.<sup>2</sup> The therapeutic action of sulfur water is related mainly to sulfur's keratolytic effect, resulting in peeling.<sup>18</sup> Schempp et al.<sup>19</sup> demonstrated in both in vivo (a 5% concentration of MgCl<sub>2</sub>) and in vitro (a 1% concentration of MgCl<sub>2</sub>) studies that magnesium ions specifically inhibit the antigen-presenting capacity of Langerhans cells and may thus contribute to the efficacy of magnesium-rich spa water in the treatment of inflammatory skin diseases. Therapeutic activities of CO<sub>2</sub> water baths (700–1300 mg CO<sub>2</sub> per kg water) are explained by a synergism between hydrostatic pressure and the chemical properties of carbon dioxide that acts directly on the blood vessels of the skin, causing vasodilation and increased oxygen utilization.<sup>20</sup> Balneotherapy with arsenical-ferruginose (no data on concentrations) water from the spa at Terme di Levico (Italy) showed effectiveness in the treatment of cervico-vaginitis (n=20) in comparison to placebo suppositories (n=10). Both clinical signs and symptoms were reduced in the intervention group with good tolerability.<sup>21</sup> Apart from immersion, drinking spa water has also been investigated for treatment of dermatologic conditions. Drinking of low-salt Avene (France) spring water (sodium, 4.9 mg/l; magnesium, 22.5 mg/l; calcium, 44.3 mg/l; bicarbonate, 234.8 mg/l) for a period of 18 days normalized the intestinal permeability in patients with atopic dermatitis.<sup>22</sup> Drinking and immersion in a selenium-rich spa water (selenate 70 µg/l) for three weeks at the care center of La Roche-Posay (France) demonstrated an improvement in patients with psoriasis.<sup>23</sup> Patients who responded to treatment had a significant increase in their plasma selenium level. In patients with psoriasis, inflammatory reactions in the skin may lead to an increased loss of selenium.<sup>23</sup>

### Balneotherapy in Dental Uses

Heat Therapy Liquid heat therapy is a complementary therapy that is highly effective for the following:

1. Promotion of healing after oral surgery
2. For the treatment of infections
3. Prevention of infections during wound healing after surgery

### How does it work

Heat creates higher tissue temperatures, which produces vasodilation that increases the supply of oxygen, nutrients, immune factors, antibiotics, and the elimination of carbon dioxide and metabolic waste

1. Increased local circulation allows antibiotics and the immune system to work more effectively
2. Promotes proper drainage of stagnant old blood after surgery.
3. Local heat promotes proper drainage of infection if infection is present. Drainage is key to successful resolution of infections.
4. Increases local circulation and allows antibiotics and the immune system to work more effectively

### How to do heat therapy

1. Gently rinse the inside of the mouth with warm-hot Saline (1/2 Teaspoon of salt to a 12 oz glass of warm water). Do this several times a day for one week after surgery. The more frequently the better. Take care to not burn yourself
2. Drink hot teas (preferably herbal) and gently circulate the tea in the mouth before swallowing,
3. Do this several times a day for one week after surgery or as prescribed.

### Psoriasis

The sulfur that penetrates the skin is oxidized and evokes various physiologic responses in the skin, such as vasodilation in the microcirculation, an analgesic influence on the pain receptors, and inhibition of the immune response. Balneotherapy for psoriasis is very efficacious. The addition of balneotherapy with mud packs and sulfur baths enhances the improvement observed in both the skin and joints in these patients. Bathing in high-concentration salt solutions may trigger the elution of various chemotactic and proinflammatory mediators (i.e., elastase and cytokines) from the affected skin of patients with psoriasis.

1. Lichen rubra planus -The often prolonged therapy can be administered in combination with bathing.
2. It is also used for the physiotherapy of the periodontal tissues.

**Conflict of Interest:** None.

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