

exactly dosed quantity of ozone outside the organism. The ozone/oxygen mixture should be passed through the blood homogeneously in the form of extremely fine bubbles; though the ozone reacts with it almost immediately, the oxygen passes up through it and collects again above the liquid, having had no influence on the reaction or its products. The blood is then administered back to the patient via normal infusion, ie at a rate of 60 to 90 drips/minute – as medically recommended for transfusions.

When working with ozone, in addition to a hygienically faultless method, special ozone-resistant material must be used at all times. Table 8 (procedure) lists the hygienic steps to be taken as recommended by Professor Beck and his Institute for Hygiene of the University of Giessen (Germany) in 1991; Fig. 14 shows the material required.

The most important indications for major autohemotherapy are: arterial circulatory disorders, infections, and diseases occurring in the context of immune deficiencies, such as eg the complementary treatment of cancer patients and in rheumatism/arthritis etc.

Rectal O₂/O₃ insufflation

The rectal administration of ozone gas is one of the oldest systemic and local forms of application (*Aubourg* 1936). In its systemic effects, ozone applied in this way has held its position as a genuine alternative to major autohemotherapy. By this method, a metabolic change (increase in ATP

and 2,3-DPG) similar to that produced by MAH can be determined after a treatment series of approximately 10 to 12 insufflations. In fact, where the same underlying conditions are present, we are, empirically, in a position to formulate that: approximately three times the total quantity of ozone, ie 4,500 µg per treatment are required via rectal O₂/O₃ insufflation to correspond to 1,500 µg in major autohemotherapy.

Rectal insufflation is carried out either with the help of an ozone-resistant syringe with attached catheter or, as shown in Fig. 15, using an ozone supply container (2) and a silicone dosing bag (1) with which, as a rule, 150 to 300 ml ozone/oxygen mixture are administered. The container (2) – with lock valve (3) – is filled directly at the generator and connected to the dosing ball (1). With a content volume of 150 ml, the dosing ball is connected with the catheter (6) via a tube system (5). Both lines to and from the dosing ball are secured by non-return lock valves.

Performance:

After opening the valve at the ozone supply bag, it is only necessary to press once to let the air out of the dosing ball, and fill it automatically with the ozone/oxygen mixture from the supply bag. Moisten or lubricate the catheter with water or vaseline (use no oily products!), introduce it slowly and carefully into the rectum and insufflate 150 ml by emptying the ball once, or 300 ml by emptying it twice.

This method of ozone application has proved itself to be convenient and practical in children; it is best to use a 50 ml or, in the case of small

children, a 30 ml syringe, insufflating a corresponding quantity of the O_2/O_3 mixture also via the catheter. Insufflation should be applied with the patient in a prone position, and may also be carried out by adults on themselves quite easily when properly instructed.

The empirically best proven indications for rectal insufflation are:

Systemically: as with major autohemotherapy, particularly also in elderly patients in whom major autohemotherapy cannot be performed where intravenous reinfusion is involved due to unfavorable vein conditions.

Topically: where pathological conditions of the intestine are involved, such as proctitis and colitis.

In children: pediatric indications are in particular immunodeficiency, ie where one infection follows the last.

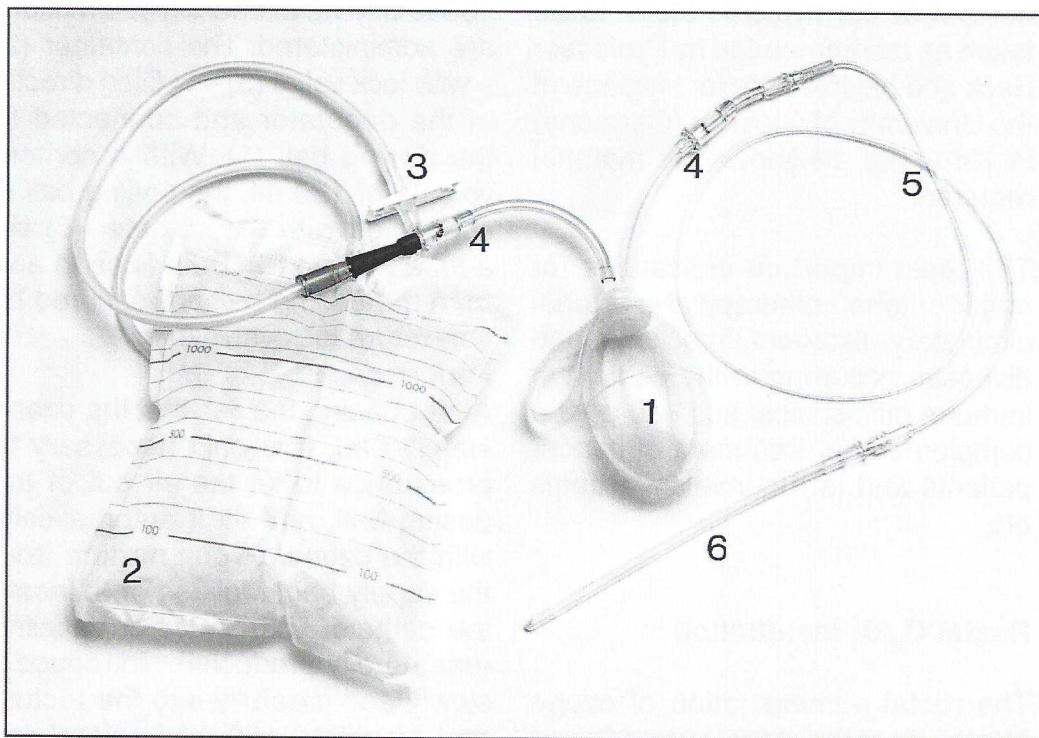


Figure 15:

Intestinal insufflation equipment for rectal irrigation of dosed quantities of O_2/O_3 . The dosing bag makes manipulation by the patient possible, thus enabling him/her to overcome the inhibitions involved in this route of administration

(1) Dosing ball (2) Ozone reserve container (3) Lock valve (4) Return valve (5) Connection tube (Luer/Luer lock) (6) Catheter

1.2 Topical applications

Low pressure ozone gas application*

For locally limited wounds, immersion in a continuous flow of ozone gas at a subatmospheric pressure under a suction cup has proved its value again and again. Here, the ozone/oxygen mixture flows continuously at the set ozone concentration through a plastic cup-shaped device fitted over the area to be treated, which has previously been well moistened with water; the residual O_3 is drawn off and reconverted to O_2 via catalysis. The pressure, ie a partial vacuum, is to be selected so that the cup adheres by itself with a gentle suction force causing the patient the least possible amount of inconvenience (low-pressure ozone immersion according to *Werkmeister*).

Pressure can be adjusted individually, and must be based on the patient's requirements and the severity of the lesion. Figure 16 shows the principle of low-pressure ozone immersion according to *Werkmeister*: it has been found to be particularly valuable in decubitus, radiation damage and fistulae.

If, as in the case of diabetic gangrene of the lower foot, it is difficult to position a suction cup – although low pressure ozone is in fact indicated – the low-pressure plastic “boot” should be used here. The patient's leg can be positioned inside it without any difficulty, the top of the boot being sealed in a gas-tight manner somewhere above the knee. This type of local ozone treatment is carried out in the same way as with a suction cup and is, as a rule, combined with a systemic form of treatment.

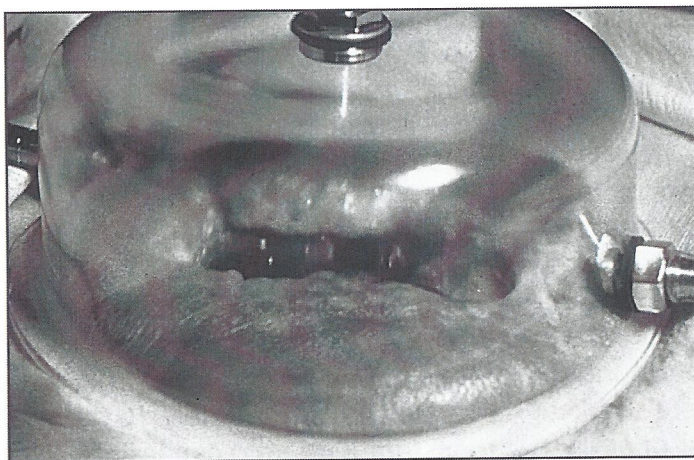


Figure 16:
The principle of low-pressure ozone gas irrigation according to *Werkmeister*

*)The term “low pressure” is used throughout this book to describe pressures below normal atmospheric pressure.

**Transcutaneous ozone irrigation/
immersion**

in ozone-resistant plastic covers

For the treatment of venous ulcers and large-area, superinfected wounds - also in the trunk region, for example - the use of ozone-resistant plastic bags and/or foils is practical. Both bags and foils are supplied with a suitable connecting piece and inlet/outlet valve.

The plastic bag is gently drawn over the extremity in question, which has just been generously moistened with water, and made gas-tight with a velcro band or equivalent.

The air is first of all drawn out of the bag via an inlet/outlet valve and then filled with an ozone/oxygen gas mixture of a selected concentration. It is sufficient to immerse the ulcer or the extremity in the indicated quantity of the gas mixture, ie the bag should not be distended. Allow the medical ozone to take effect for about 15 minutes. The remaining (residual) ozone must be reconverted to oxygen using a catalyzer to avoid any and all inconvenience to the respiratory tract.

Topical ozone treatment in the trunk area:

Where we are dealing with a large area needing treatment (eg in burns, eczemas or fungus/lichen infections), it is first to be well moistened with water, then covered by an ozone-resistant plastic foil (fitted with an ozone inlet/outlet valve) sealed around its edges with ozone-resistant medical adhesive tape (eg Leucosil or equivalent); the air is then drawn off to be replaced by ozone at the required concentration.

Here too, the treatment time (ie exposure to ozone) is to last c 15 minutes before drawing off the residual ozone for catalysis back to oxygen. All materials coming in contact with the patient must naturally be disposable.

**The application of ozonized
water**

Ozonized water is ideally indicated as a topical application for all kinds of infected wounds including fresh or recent surgical interventions, for example in the form of ozonized water compresses. These are also a valuable complementary treatment form. This is because, when it is in an aqueous medium, the polar O_3 molecule is surrounded by polar H_2O -molecules of the "same structure", and is thus in an optimal position to act in the local treatment: inflammations, burns and other skin lesions. Ozonized H_2O compresses produce rapid and considerable pain relief, particularly in the initial stages of inflammatory processes as edema formations. The local application of O_3 activates cellular metabolism, producing an increase in ATP and subsequent repolarization of still regenerable cells within the close proximity of the lesion; edemas consequently subside.

As a rule, ozonized water is used which has been freshly prepared from bidistilled water (*aqua bidestillata*) which absorbs a maximum of 20 µg ozone per ml water and has a half life of approximately 10 hours at room temperature; it can thus be used throughout the day (see Figure 12 a+b). In a refrigerator, the half life is about 5 days, which means continu-

ation of ozonized water treatment is possible at home. Ozonized water is completely safe to use. Practically no gas is released, so that no ozone escapes into the air. No overdosage is possible, as the quantity of ozone used is limited by its solubility in water. However, ozonized water should be made and kept in glass containers only (preferably in a cool place and protected from sunlight).

The most important indications for H_2O/O_3 are:

Fresh/recent wounds, infected wounds, infection by fungi, lichens or molds, herpes simplex, herpes zoster, external otitis.

In dental medicine, a discipline which has supplied us with our most important knowledge about medical ozone-water and its properties, H_2O/O_3 is used both in disinfection as well as in wound treatment after tooth extractions, as well as thrush (aphthous stomatitis) in the buccal cavity, candida or parodontitis.

Rectal O_2/O_3 insufflation as a topical application

In addition to its systemic effect, the local effect of rectal ozone/oxygen gas insufflation is also valuable in the treatment of colitis and proctitis.

Method and dosage:

In ulcerous colitis, high concentrations but small volumes of ozone are used: 80 to 100 $\mu\text{g/ml}$ in a disposable 50 ml syringe. When no more hemorrhage occurs, this concentration can be reduced to a medium range of 40 to 60 $\mu\text{g/ml}$, and then finally down to the systemically effective concentrations between approx. 20

to 30 $\mu\text{g/ml}$, whereby the gas volume may be increased to 300 ml; the same dosage is effective in the treatment of proctitis, a fact which has been demonstrated in a large-scale study by *Knoch* 1987/1995.

Treatment of fistulae:

To provide for an infiltration of ozone/oxygen mixtures into fistulae, a combination of catheter and suction cup (see above) is highly useful here; the fistular passage is simultaneously evacuated and irrigated by the ozone/oxygen mixture, as described by *Werkmeister* 1981; fistulae in *Crohn's* disease can also be treated in this manner (see also fig. 23).

Here too, the use of ozonized water (H_2O/O_3) is highly recommendable.

Intraarticular ozone injection

Intraarticular ozone injections, principally for the knees and shoulder joints, have shown themselves to be effective and relevant in acute and chronic, painful diseases of the joints. In practical orthopedics, this method of treatment represents a good alternative, providing rapid pain relief, subsidence of swellings, decongestion of hematomas/bruises, a reduction in temperature and an improvement in joint mobility.

The most important indications are: Activated forms of gonarthrosis, acute conditions of the shoulder joints with a partially limited or inhibited motile function (total or partial stiffness of the shoulders), chronic diseases of the shoulder joints accompanied by calcification and terminal, painful restriction of movements.

Here, intraarticular ozone applications

are understood as a complementary medical treatment method of painful joint conditions (rheumatic, arthritic or otherwise) – with a low therapeutic risk (*Siemsen* 1995).

Dosage is within a range between 150 and 400 µg ozone per treatment session, at volumes of 7 to 20 ml.

Intraarticular ozone injections are at all times to be performed in accordance with hygiene guidelines (presently applicable in Germany) as given in Table 9 (*Beck* 1998).

Intraarticular injections demand precautionary measures – particularly aseptic conditions to prevent infection!
(Guidelines of the German Society for Orthopedics and Traumatology/*Deutsche Gesellschaft für Orthopädie und Traumatologie*, 1988)

Caution! Local and/or general infections MUST be avoided, especially where skin lesions or defects are present in the vicinity of where the injection is applied:

- Disinfect your hands first using officially listed/registered, alcohol-based preparations (in Germany RKI/DGHM). Observe a period of action > 30 sec and up to 5 minutes with suspected hepatitis B and C virus (HBV, HCV) carriers. Even better: (sterile) disposable surgical gloves!
- Alternatively: surgical hand disinfection, sterile protective gloves, sterile protective clothing, sterile surgical covers (eg when touching the skin over the joint to be treated).
- Disinfect the patient's skin around the injection site using an officially listed/registered skin disinfectant based on alcohol: spray liberally over the site, and rub in using a sterilized gauze pad. Observe a period of action > 1 minute.
- Extract the ozone/oxygen gas mixture from the ozone unit/generator via a bacterial filter fitted onto the teflon extraction valve using a sterile, siliconized, 30 ml disposable syringe.
- Intraarticular injection of the O₂/O₃ mixture is carried out using a long, thin, sterile, disposable cannula of eg 0.8 x 40 mm (size 2) or 0.6 x 60 mm.
- Cover the site of injection with a (sterile) instant-type wound plaster/dressing.

Table 9: Aseptic procedure in intraarticular ozone injection