THE USE OF PARAFFIN IN LEPROSY

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Introduction

Paraffin can be very useful in the management of symptoms secondary to leprosy. Yet the observations of this author made while a staff member of the National Leprosarium, Carville, Louisiana indicate that there is not widespread use by medical missionaries in this field.

Several readily recognizable circumstances may contribute to this void, such as budgetary problems, lack of library facilities or professionally trained personnel. It is not the purpose of this paper to deal with these aspects.

It is hoped that this paper will serve as a guide for the use of paraffin in leprosy. The information contained herein has been written in the light of the modern paraffin unit as it is known in the United States of America. Although these may not be available or practical in many locations, little need be said about the ingenuity, resourcefulness or ability to improvise of those workers found in these areas. Specific information regarding one means of substitution of equipment will be found in reference 5 of the bibliography.



FIG. A. The paraffin unit, showing a thermometer in the bath at far corner.

Historical

The use of paraffin for therapeutic purposes dates back to 1829^1 . Incorporated into gauze to form what was then called a paraffin dressing, its major use was in the treatment of burns. During the early 1900's the formula for the mixture was a closely guarded secret. Today, pure paraffin is used of a specific melting point (MP) ranging from $48^\circ-58^\circ$ C. To this is added a specific amount of pine oil or light petrolatum. Originally the baths were heated by gas. Since 1926 a thermostatically controlled electrical heating unit has been commonly used.

Frequency of use

At the National Leprosarium paraffin is used extensively. More than 4,000 treatments were administered during 1957, which is an average of 337 per month. As many as 22 treatments have been administered from one unit in a single day.

Sanitary aspects

During such intensive use one might justly be concerned with the sanitary aspects. Culture samples taken from our unit for upper extremities immediately following immersion of an extremity and at ten-minute intervals for a total of six samples, all proved negative. The temperature of operation (53° C.) is above that at which bacteria, with few exceptions, will grow. In this regard, two practices are worthy of mention.

- 1. Prior to immersion, the part to be treated is washed with soap and water and then thoroughly dried.
- 2. At the close of each work day, the temperature of the bath is increased to 82°-93°C.

Techniques of application

- Continuous immersion: The extremity is immersed to the desired level and is kept immersed throughout the treatment. A thin layer of paraffin congeals over the surface of the part, forming a "glove" or "stocking". The joints and digits are not moved during treatment as this would cause the glove to tear or crack. Such cracks allow melted paraffin to leak into the glove causing a hot spot on the skin. For this reason some persons prefer to remove the part at least once prior to continuous immersion. The congealed layer is of lower temperature than the melted paraffin, thus allowing treatment without burning the skin.
- 2. *Dip immersion:* In this method a thicker glove is formed by repeated brief dips. The patient is instructed not to move the

joints in order not to crack this glove. Following a minimum of six dips, the part is immersed for the duration of the treatment.

- 3. Dip wrap: The extremity is dipped in and out of the bath to produce ten to twelve layers of paraffin, being careful not to crack these layers as they are applied. The part is then wrapped in a thin sheet of clear plastic $(20'' \times 24'')$. This prevents the paraffin from adhering to the towel, a common complaint. A large bath towel is then wrapped over the plastic to retain heat, and is secured by means of a two-inch spring clip. This prevents the towel from working loose until treatment is completed. When the 20-minute treatment duration has elapsed, the plastic sheeting is removed and rinsed. After drying it is ready to be used again.
- 4. *Brush wrap:* Occasionally the part being treated is not easily immersed. Then the paraffin may be "painted" on with an ordinary one- or two-inch paint brush. Following application of ten to twelve layers of paraffin, the area is covered with towels or a blanket for the prescribed treatment time.

Physical findings

Upon immersion of an extremity into the molten paraffin, solidification occurs on the immersed part. This is a result of heat loss from that layer of paraffin in contact with the skin. LAMPERT² measured the temperature differences of this layer of congealed



FIG. 1. Clear plastic sheeting is wrapped about the treated extremity.



FIG. 2. A large bath towel is then wrapped over the plastic to retain heat.



FIG. 3. The towel is secured by means of a two-inch spring clip.

paraffin as compared to the melted paraffin. The findings of his study bear out the theoretical explanation of why the application of melted paraffin produces no burn.

ACTUAL TEMPERATURES OF APPLIED PARAFFIN (LAMPERT)

Time (of application)	Temperature of paraffin*
few seconds	55°C.
2 minutes	43.9°C.
3 minutes	41.5°C.

*Applied in the form of paraffin packs.

There is on record a treatment given with paraffin at 82° C. with no burn resulting³, however, this report states that the bath was too uncomfortable to tolerate continuous immersion of the part. The **skin** temperature of the part during treatment has been studied^{1,3} **using** a galvanometer and thermocouple. ZEITER reported skin temperature as found in various techniques of paraffin application. In dip wrap, the skin temperature fell from 48.8°C. (the average temperature during the first 60 seconds of application) to 43.3°C. at five minutes and 40.5°C. at ten minutes.

VOGEL and WEINSTEIN report a skin temperature rise of 11.1 to 13.9 degrese immediately following conventional paraffin pack technique and then slowly decreased in temperature as the treatment progresses¹.

SEDWITZ made similar studies on the reflex effect upon the untreated extremity. He found paraffin applications to one extremity caused the opposite extremity to react at once with an elevation of skin temperature of 1.4 degrees. Even though a slow decrease in the temperature followed, it remained elevated by 0.47 degree for thirty minutes from the time of the initial application⁴.

LAMPERT² suggests that the heat produces sweat, thus forming a protective layer between the skin and paraffin, and preventing significant contact between the two. As the temperature of the paraffin rapidly drops following application, and as the circulatory system disperses heat from the extremity, temperature of the paraffin during most of treatment is well within tolerance.

Still another theory is related to the low specific heat of the paraffin^{1, 3, 4, 5}. The contention is that heat yielded per unit mass is significantly less than that produced by water (specific heat of 1.0°) of the same temperature. However, upon application, the temperature of paraffin is lowered to the hardening point, a significant amount of heat is released (heat of fusion) and transferred to

the skin. Solidified paraffin is a poor thermal conductor, and acts as an insulator to the part being treated. In immersion type treatments this prevents the melted paraffin of high temperature from actually contacting the skin.

Ingredients

With regard to the formula used, several variations of the proportions of oil to paraffin are in use. However, the one which has been used for several years at the National Leprosarium is as follows:

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Paraffin of 53°C. MP-seven (7) parts (53 lbs.).
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Oil (light petrolatum)—one (1) part (1 gallon).

This formula offers a mixture with an operational MP of 53°C. The MP of any mixture may be lowered by the addition of a greater proportion of oil than in the above formula.



FIG. 4. The congealed paraffin forms a glove.

Indications

Paraffin may be prescribed when local heat is desirable. The liquid immersion treatment has the asset of affecting all the convolutions, folds, and angled surfaces of an extremity simultaneously. Although not conclusive, heat is said to have a sedative effect and may help to relax muscle spasm⁶. In addition to use in general medical and surgical conditions, several operative procedures and secondary symptoms common to leprosy may be treated by paraffin applications. This may be the sole treating agent or it may be coupled with other modalities of physical medicine, namely massage and exercise.

Dyshidrosis

Dyshidrosis, commonly seen in leprosy, leaves the skin dry, tight, and prone to crack on ordinary movements. Paraffin may be used regularly to improve skin texture and prevent cracking. Satisfaction is frequently expressed by the patient following this treatment.

Neuritis

At Carville, paraffin has been the treatment of choice for chronic and sub-acute neuritis.

Nerve transposition

Should a surgical transposition of a nerve be carried out, paraffin is again employed following complete healing of the incised area. Its use usually precedes massage and exercise, which are directed at prevention of adhesions, reduction of edema, and muscle strengthening.

Muscle-tendon transfer

In patients who are candidates for muscle-tendon transfers, physical therapy employing paraffin is prescribed both pre- and post-operatively. The pre-operative aims of treatment are:

- 1. Maintain or increase joint range of motion.
- 2. Maintain or increase muscle-tendon length.
- 3. Lubricate and soften atrophic skin.

Post-operative care is directed toward:

- 1. Re-education of the tendon transfer procedure.
- 2. Prevention of adhesions.
- 3. Reduce stiffness from casting or bandaging.

Hydrotherapy is usually employed initially following removal of bandages or casts. Paraffin is resumed following healing of incisions. It renders the skin oily, soft and pliable, providing excellent condition for massage.

Therapeutic exercise

It is often desirable to precede exercise with an application of heat. This is particularly true where stretching of contracted joints is of primary importance. Here again paraffin has been used with great frequency.

Contra-indications

Contra-indication for the use of paraffin are few. However, these should receive due regard. They are:

- 1. Open skin lesions.
- 2. Sensory loss or impairment.

Discussion

The paraffin bath, which has been used for well over a century now, allows for a great number of patient treatments when employing the dip-wrap technique of application. Although there are no objections to other techniques of application, in a centre where many treatments are to be administered during the course of a day, this method has proved to be most expedient. It must also be mentioned that the drip-wrap method of treatment will allow the patient to go elsewhere on other business or treatment during the course of his twenty-minute paraffin treatment time.

It will be noticed that the contra-indications occur with great frequency in a given population of leprosy patients. In spite of sensory loss, patients have been treated over a number of years with no record of a burn. It will be noted that the temperature is maintained at 53° C. This is a full five degrees below the recommended operating temperature of units used for patients with no sensory loss. By frequent observation of the temperature, patients are never treated in the unit should the temperature rise above the 53° C. level. A raised grill covering the bottom of the unit prevents the treated part from directly contacting the bottom, where the heating element is located, and therefore, the warmest part of the unit. This comes as an integral part of the unit as it is sold in the United States of America.

The physical findings have been discussed at length. Supportive information regarding temperature studies and other pertinent investigative projects are included. The ingredients, no longer held secret, may vary as to proportion of oil to paraffin. A satisfactory formula has been offered.

Patient evaluation and treatment is the sole responsibility of the physician. It is he who directs a prescription for paraffin treatments to the physical therapist.

Many secondary complications of leprosy which have been successfully treated with paraffin at Carville have been listed. This is not meant to be an all-inclusive listing. Nor should it serve as a stereotype guide for treatment. One can readily see that this topic has been treated extremely lightly. However, this is not the purpose of this paper. These are merely cited to demonstrate the usefulness of paraffin in the management of the leprosy patient.

Conclusions

Topical application of heat to the extremities, by means of the paraffin bath, is a useful treatment in complications of leprosy. The paraffin bath permits accurate temperature control, giving maximum benefit from the use of heat.

Methods and their applicability are described. Excellent symptomatic improvement and limited physical improvement can be obtained. Equally important is its use as an adjunct in preventing deformity.

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