Noninvasive treatment of axillary hyperhidrosis with Nd:Yag laser

INTRODUCTION

Hyperhidrosis is the medical term that defines a pathology which consists of an excess of perspiration. The most frequent sites for this occurrence are the arm pits, but it can also happen in the palms of the hands and the soles of the feet. Other focalized hyperhidrosis exists which is not the purpose of this study. Hyperhidrosis is due to the malfunction of the eccrine sweat glands.

Osmidrosis is a pathological situation which is characterized by the presence of bad odor originating in the bacterial action over the apocrine gland secretion. The area in which it appears more often is in the arm pits but it can also present itself in the inguinal area. Bromhidrosis is when hyperhidrosis and osmidrosis are combined. These pathological situations are a habitual consultation and more and more frequent in our daily practices. For the patient, beyond being a physical and psychological problem it many times results in social invalidation.

It has been mentioned in published articles, many types of medical dermatological treatments exist, such as the use of local or oral antiperspirant medication. When these treatments don’t provide the desired effect, other non-surgical treatments can be resorted to such as botulinic toxin type A and iontophoresis. In more resistant cases, it will lead to the surgical phase, of which we can highlight local resection in the arm pit or the sympathetic system such as videolaparoscopic sympathectomy.

In this work we would like to share our 8 year experience in the use of a 1064 nm Neodymium:YAG laser equipment interstitially applied to diminish the axillary sweat gland populationi.

CLASSIFICATION

Hyperhidrosis can be classified in two major groups:

1 - Generalized hyperhidrosis
2 - Localized or focal hyperhidrosis

General hyperhidrosis may be caused by thermoregulatory and mental perspiration. Emotional activities increase perspiration, especially in the palms of the hands, the soles of the feet, and in a lesser degree in the inguinal region and face. Localized or focal hyperhidrosis affects one or more areas of the body in a symmetrical manner.

Axillary perspiration can be continuous or, more commonly, in phases and can be induced by heat or mental state. It is not common before puberty. There is also an asymmetric hyperhidrosis that doesn’t stain clothes. On the other hand, Inabai classified axillary hyperhidrosis in two sub-groups, the essential and the symptomatic.

Essential hyperhidrosis has almost no odor and is only a condition of excessive perspiration that doesn’t stain clothes. Symptomatic hyperhidrosis is always followed by the “goat odor” of apocrine bromhidrosis and discoloration of clothes. He also defined osmidrosis as a condition of only excessive odor that originates in the apocrine glands, and bromhidrosis as the combination of excessive odor and perspiration. Clinically, osmidrosis is many times used as a synonym of bromhidrosis.

ANATOMICAL DESCRIPTION

The eccrine glands are made of three segments: the conduit within the epidermis, the intracutaneous conduit and the secretory portion.
The basal spiral lies in the edge of the corion and the subcutaneous fat or in the third lower portion of the corion. The secretory portion is integrated by the basal spiral and the conduit in equal parts.

The apocrine glands, like the eccrine glands, are made by three segments: the intraepithelial conduit, the intracutaneous conduit and the secretory portion. Since the apocrine glands are originated by the primary epithelial germ, the conduit of an apocrine gland leads generally to a pilosebaceous follicle, entering in the infundibulum above the entrance of the sebaceous conduit.

An apocrine conduit can occasionally open directly to the surface of the skin near the pilosebaceous follicle. In contrast to the eccrine glands, the basal spiral of the apocrine glands that are in the subcutaneous fat are made entirely of secretory cells and don’t contain ductal cells. The nerves, derivatives of the sympathetic nervous system, innervate the eccrine and apocrine glands. The eccrine glands are innervated by collinergic nervous fibers whereas the apocrine glands are innervated by adrenergic nervous fibers.

The main function of the eccrine secretion is thermoregulation, although other accessory functions include the maintenance of health and texture of the skin. The apocrine glands are less active before puberty. They don’t have a thermoregulatory function. In animals, the scent of some apocrine glands can act like pheromones.

**Physiopathology of axillary odor**

Axillary odor originates mainly from the interaction of the apocrine sweating with microorganisms. The apocrine sweating is sterile and odorless when it appears for the first time in the surface of the skin. Axillary bacteria degrade apocrine sweating and produce bad scent a few hours later. Components of the greater scent are fatty acids with short chains and ammonia with typical acid scent. The strong axillary scent tends to be associated with one richer provision of the bacterial flora and especially with more corynebacterium.

**Handling of axillary hyperhidrosis and bromidrosis**

Numerous modalities of treatments have been used in the treatment of hyperhidrosis and bromidrosis. These include topical methods, systemic medicines and surgery. All have their limitations and collateral effects. In our daily practice, the botulinic toxin injection is the non-surgical method of choice and as a surgical method we prefer the Laser-adenolysis with Nd:YAG when the problem affects only the arm pit, and videothoracoscopic sympathectomy when the problem includes also the hands.

**SURGICAL TECHNIQUE**

Several types of surgical methods have been developed. Thoracic sympathectomy is effective but it brings the attached risk of important complications such as pneumothorax, Horner’s syndrome, subcutaneous emphysema and compensatory hyperhidrosis. Local surgery is the best healing method for axillary bromidrosis. There are 3 basic types described by Bishal et al.:

- **Type I** removes the subcutaneous tissue but not the skin.
- **Type II** removes the skin and the subcutaneous tissue in block.
- **Type III** includes a partial removal of the skin and the subcutaneous tissue as well as the subcutaneous tissue of the area that surrounds it.

Procedure type I seems to be the most applicable one to eliminate the bad scent and the hyperhidrosis because most of the apocrine and eccrine glands are located in the subcutaneous tissue and in the subcutaneous-dermal union and there is no need to remove the skin. Breach supported a procedure that consists of performing 3 parallel transversal 1.5 cm incisions along the axillae. Through these incisions, the skin of the affected area is dissected and the subcutaneous fat is removed in the same way done for grafts of total thickness. Inaba and Ezaki developed a radical technique using a subcutaneous tissue shaver. This instrument combined a special razor blade that slides under the skin and a counter pressure roll that compresses the skin with which the skin is sufficiently thinned in order to remove the sweat glands and hair follicles through a small cutaneous incision. It may cause tearing of the skin because the edge of the razor cannot be seen. Horrma et al. used a disposable plastic machine to extract the sweat glands and the follicles of the hair. In the last few years, techniques that use ultrasound and arthroscopic equipment have been proposed, but we think that these systems make the procedure more expensive. In 1999 we begun our experience with the use of the Nd:YAG laser in the treatment of laserpolis in order to diminish localized adipocytes. In the search of other possible applications for this equipment we thought of the possibility of treating sweat glands and axillary hair through the use of this laser under the axillary skin. After performing some anatomical studies and in vitro tests that proved the safety and efficacy of the method, we initiated treatment in patients. Preliminary results were presented in several international congresses since 2000 and were later published in cooperation with Dr. M. Sandhoffer from Austria and Dr. M. Kloepper from Germany.

**MATERIALS AND METHODS**

Laser Adenolysis is a surgical procedure performed under tumescent local anesthesia during which the apocrine and the eccrine glands are destroyed by laser energy. On top of the direct destruction that the laser produces by effect of vaporization and carbonization of tissue, the laser’s thermal effect creates an interruption in the sympathetic innervations of the sweat glands so it also works at the level of nervous stimulation that produces sweating. The technique starts with marking the areas of higher sweating, based on the iodine test, or Minor test, that identifies the areas of greater glandular density. Antiseptis of the skin is then performed with iodopovidone. Anesthesia is initiated with a superficial tumescent Klein solution composed by: 2% lidocaine 600 mg saline solution 500 ml molar bicarbonate 10 ml adrenaline 1 ml

A small incision of 5 mm is performed on the internal side of the arm over the half-axillary vertical line, 2 cm below the marked area. Then local tumescent anesthesia is infiltrated in the axillary concavity using a Klein needle, keeping it in a superficial plane as close as possible to the skin. Generally a total of 200-250 ml of solution is infiltrated in each armpit using our B&S peri-static pump. After waiting for the 15 minutes of latency required by lidocaine to reach an effective anesthetic effect, a specially designed 4 mm spatula is used to separate the subcutaneous tissue from the dermal. A 300 micron silica/silica optical fiber is prepared, which will deliver the laser inside the tissue using a 2 mm metal guide that allows us to advance in consistent manner inside the pre-developed tunnels made by a spatula.
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Parameters are programmed in the Neodymium:YAG laser emitting equipment (Fotona XP-2), starting the session with the following parameters:

- QC (Quasi Continuous) Mode
- Power 10 Watts
- Time On 1.0
- Fiber 300um
- Frequency 40 Hz
- Time off 0.6 sec.

The existence of a second Helium-Neon red laser that works simultaneously allows us to know at all times, through transillumination, where the tip of the optic fiber is emitting. This tip must be focused toward the deep dermal layer and the more superficial portion of the subcutaneous axillary tissue. The laser, when in contact with the tissue, generates a photo-hyperthermal effect conductive to cell vaporization of the sweat glands. Keeping the instrument in continuous movement allows for working safely in order not to produce lesions in the skin. Local temperature can be monitored constantly through a digital thermometer, and if it is believed to be necessary, gel or cold air can be used as epidermal cooling methods.

Once the laser application (Figure 1 and 2) over the pre-marked area has been finished, the laser-denaturized tissue is removed using a 30 cm long, 3 mm diameter cannula of our design, which has a 2 cm active part where 14 perforations with cutting edge are grouped in the center of the circumference. The cannula is connected to our peristaltic pump in which we invert the orientation of the rollers with which we provide the necessary vacuum for an efficient aspiration. The aspiration technique is performed against the underlying skin with a longitudinal swing movement that must be continued until the contour of the cannula is seen “transparently” through the skin. If a liposuction were made without the previous application of the laser, a more aggressive cannula must be used to efficiently remove the apocrine glands. Because the eccrine glands are located in the deep dermis, it is not easy to treat axillary hyperhidrosis with a simple liposuction.

When treatment is finalized a special curing treatment is performed that consists in the application of a medical grade adhesive solution (Adhesol) over the axillary skin, which allows us to adhere to it an absorbent gauze which also has the compressive function of avoiding liquid accumulation.

CASE HISTORY

From 2000 to 2007 we used this technique with Neodymium:YAG laser to treat 252 patients affected by axillary hyperhidrosis and bromhidrosis. The first 180 patients were treated with equipment manufactured by DEKA from Italy, but with this system we had a power limitation of 6 Watts maximum, so in the last 72 patients we used a system manufactured by Fotona from Slovenia, which allows us to modify power up to 22 Watts. Patient population was divided between 74 men and 180 women, average age being 27.4, oscillating between 45 and 17 as oldest and youngest respectively. Each surgery lasted on average 40 minutes, and patients left the clinic between 30 minutes
and one and a half hours after the procedure was concluded. Nobody referred with post-op pain. Bandages were left on for 48 hours.

**COMPLICATIONS**

The complications found were:

1. Hematoma:
   
   One case which was identified during cur- ing at 24 hours. Aspirative drainage and cleaning with physiological solution with adrenalin to diminish the bleeding was applied, placing again an elastic compression bandage.

2. Sectors of partial necrosis of the cuta neous cover:
   
   Six cases which were treated with cica trization creams based on: extract of Centella asiatica, neomincne, procyanidolic oligomers, zinc undecylenate, and that required postoperative follow-up for 3 weeks until complete healing was achieved.

3. Infection:
   
   We have not had cases of infection.

4. Scar retraction and adhesions to deep layers:
   
   Fifteen cases showed some degree of scarring fibrosis and were dealt with using 5 fluorouracilo21 according to our protocol which obtained satisfactory results in all cases.

5. Relapse of 100% of perspiration:
   
   We have not had total relapse events.

6. Relapse of 50% of perspiration:
   
   8% which were retreated 6 months after the first intervention.

7. Remaining perspiration considered as 20% of the sweating:
   
   Most of the patients recover 20% of previous perspiration with the passage of time and the recovery of sympathetic innervation, which is considered normal and which is perfectly manageable with antiperspirants, a reason for which they did not require surgical correction.

**REFERENCES**


17. Klöpper M. Laser assisted Liposuction of the subaxillary sweat glands. World Congress on Liposuction Surgery Oct 4-6 2002, Denver Colorado USA


