

Olfaction regained, using the Polite yawning technique. A brochure for laryngectomees

This is part of an edited version of the Book and CD-rom in Dutch:

**‘Reukrevalidatie na totale laryngectomie;
een handleiding voor logopedisten’
by Rianne Polak, Corina van As, Frits van Dam, Frans Hilgers.
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Key points

- ! After total laryngectomy olfaction (the sense of smell) is significantly impaired in most laryngectomized patients.**
- ! A simple method is presented here to rehabilitate the sense of smell in these patients.**
- ! This rehabilitation method is a nasal-airflow-inducing-manoeuvre, the so-called ‘polite yawning technique’.**
- ! Most patients can learn this manoeuvre in a fairly short period of time.**
- ! Research has shown that patients value the fact that they are able to smell again and that they feel it enhances their well-being.**
- ! It is recommended that rehabilitation of the sense of smell is integrated in any comprehensive rehabilitation program for laryngectomized patients.**

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Introduction

Blinking, swallowing and breathing are actions done continually with no conscious effort. Smelling is another such natural function, occurring unnoticed and continuously. For laryngectomees, however, the ability to smell is not so common; most odours pass them by.

This unfavourable result following a total laryngectomy has been studied extensively at The Netherlands Cancer Institute/Antoni van Leeuwenhoek Hospital, Amsterdam, The Netherlands. Based on these studies, a method was developed that can be used by laryngectomees in order to learn to smell again. The method described in this manual and referred to as the Nasal Airflow Inducing Manoeuvre (NAIM) or 'Polite Yawning Technique', can be taught to patients by their Speech Language Pathologist (SLP). As a result, the ability to smell may become a natural function once again for laryngectomees.

Olfaction is a relatively underexposed topic. For that reason the first chapter of this manual contains detailed information on the anatomy of the nose, olfaction disorders and the consequences of these types of disorders on daily life. The second chapter deals with total laryngectomy, its influence on olfaction and the history of rehabilitation of olfaction after total laryngectomy. The 'Polite Yawning Technique' and its utilization in the speech therapy rehabilitation program are explained step-by-step in the third chapter. In chapter 4 instructions are given for treatment in specific situations.

The appendices of this manual are included as practical supplements to what has been described throughout, to improve the rehabilitation process. To the same end, two Power Point presentations have been included on this CD-ROM, containing practical overviews of the theory discussed in the manual: one meant for the SLP and the other for the patient.

The Dutch Cancer Foundation/Queen Wilhelmina Fund has made it possible for us to write this 'book'. The Dutch Association for Laryngectomees has also been involved, in particular in assisting with the writing of the patients' manual.

Amsterdam, 2003/4

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I. Olfaction

Although the olfactory organ is better developed in many animal species, scents are also very important to humans. Among others, smell does, for instance, influence mood (Rubin et al., 1984; Herz and Cupchik, 1992) and plays a role in procreation and eroticism (Vroon et al., 1994). In addition, smell is important in memories (Schab, 1990), taste and digestion (Van Toller, 1999). Furthermore, it protects us from harmful influences (Vroon et al., 1994). A scent smelled again after years can bring back memories and images of the past. An unpleasant smell can spoil one's appetite, while the scent of freshly baked apple pie can make your mouth water. Some scents will relax you, as opposed to those, which will induce you into taking immediate action, like gas or smoke.

Normal anatomy

Smelling is a complicated process, with many unknowns. It is for instance still unclear which characteristics of chemical substances actually create the scent (Vroon et al., 1994). One thing that is certain, however, is that the air we breathe in and out plays an essential role in the process of smelling. Odours consist of molecules, which are carried to our nasal cavities by the air that we are breathing. The airflow that enters our nose upon inhalation is called *orthonasal airflow*, which plays an important role in olfaction. People usually breathe through their nose, automatically resulting in orthonasal airflow. This leads to a continuous and automatic smelling of scents. This is a *passive* smelling; it costs almost no effort.

The airflow passing the nasopharynx into the nose is called *retranasal airflow*. As with orthonasal airflow, this airflow also plays a role in olfaction, but one, which is merely related to taste (Vissink et al., 2001). Taste is mainly determined by the sense of smell. The retranasal airflow is also generated by mouth and tongue movements used in chewing and swallowing (Burdach and Doty, 1987). The perception of odours of food based on this retranasal airflow is a significant contributor in the sense of taste (Griep et al., 1997).

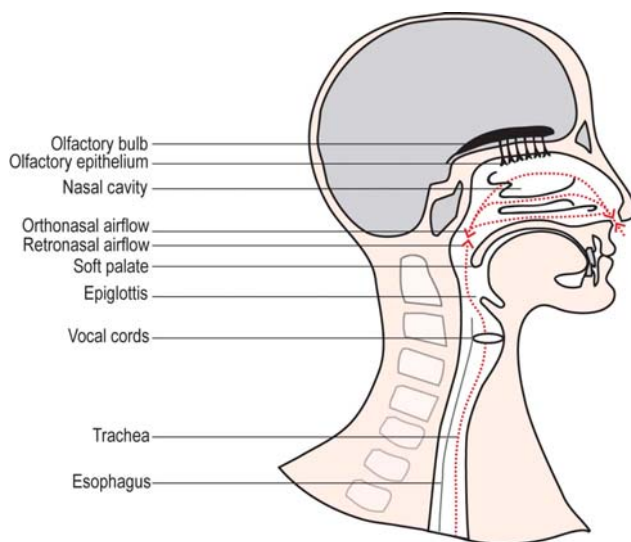


Figure 1. Normal anatomy with orthonasal and retranasal airflow

When the nose is occluded during eating or drinking, the importance of the olfactory organ for taste becomes obvious. The absence of airflow causes a decreased sense of olfaction and thereby a decrease in the fine nuances of taste. Only the four basic tastes - sweet, sour, salt and bitter – will then be perceived. Cutting off the nasal airflow will thus lead to no sense of smell at all and a decreased sense of taste.

The perception of odours occurs at the olfactory organ itself, which is called the *olfactory epithelium*. This is a patch of specialized epithelium of approximately 1 cm². It is located within each nasal vault, at the roof of the nasal cavity, the adjacent superior part of the *nasal septum*, and the *superior concha*.

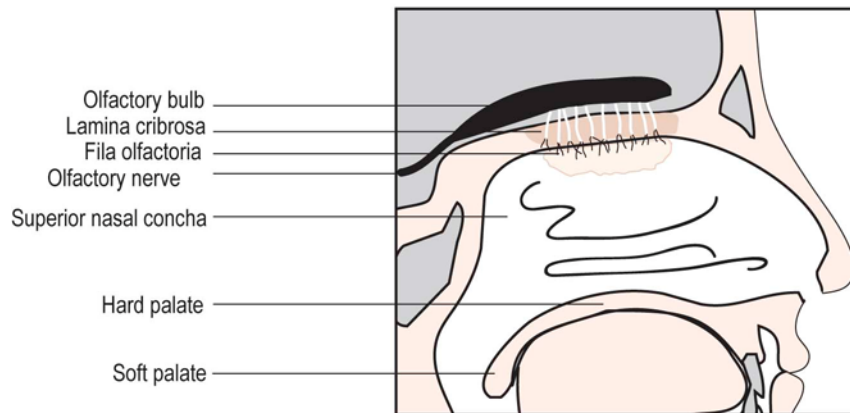


Figure 2. Cross-section of the nose

The olfactory epithelium consists of primary olfactory neurons, basal cells, Bowman's glands and supporting cells. The neurons are elongated cells with, at their underside, in the nasal cavity, dendrites with olfactory hairs. These hairs, named cilia, are situated in a mucous layer and contain receptors, which capture the odours carried by the orthonasal and retronasal airflow. In this mucous layer, produced by the olfactory glands, the odour molecules are dissolved and the olfactory information is passed to the nerve fibres at the upper side of the olfactory epithelium. These thin fibres, *fila olfactoria*, join and pass through openings in the *lamina cribrosa*. Together, they there form the *olfactory bulb*. This olfactory bulb is situated under the cerebrum and against the frontal lobe. It is the beginning of the olfactory nerve (N.1). This nerve has connections to the rhinencephalon, which consists of the brainstem, the limbic system, the hypothalamus and the cortex. These are the structures of the brain responsible for olfaction and all that is related. When odour information has been passed to the brain, the odour can be smelled consciously or unconsciously and consequently an action or reaction may be initiated.

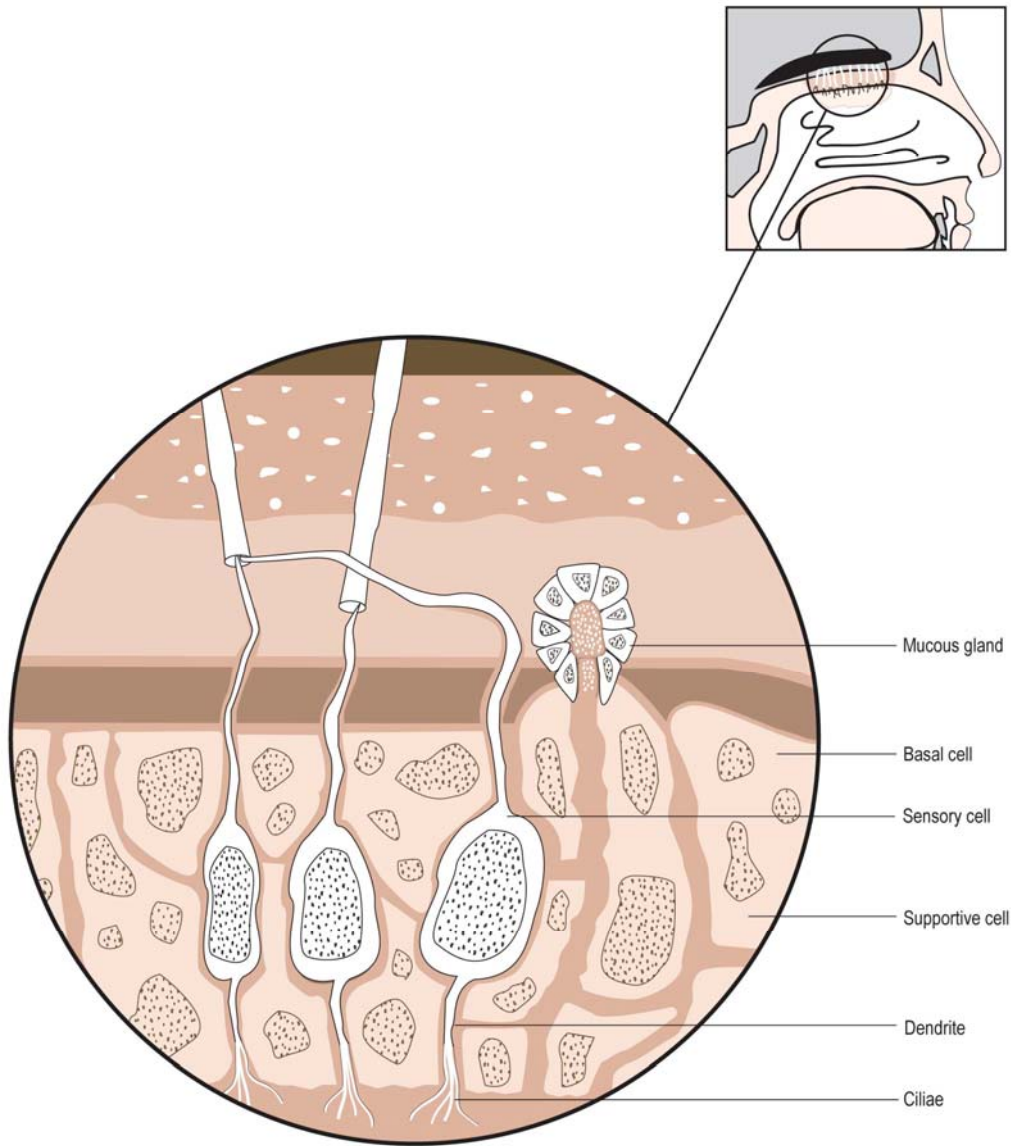


Figure 3. The olfactory epithelium

The trigeminal nerve (N.5) is responsible for the sensibility of the countenance, but also, like the olfactory nerve, for the perception of specific odours. Some branches of this nerve end in the nasopharynx and oropharynx. Receptors of these nerve endings are sensitive to high concentrations of irritating substances such as ammonia, white spirit, vinegar, smoke and cocaine. Perception of such hazardous substances gives a sensation of irritation. Therefore, the trigeminal nerve is considered the protector against harmful influences (Vroon et al., 1994; Broek and Feenstra, 1995; Doty and Kobal, 1995; Kahle, 1995; Nickel, 1997; Sobotta et al., 2000).

Olfaction disorders

Smoking, age, environmental factors and gender are four factors that influence the quality of the function of the nasal epithelium (Doty et al., 1984; Eskenazi, 1986; Doty, 1992; Mair and Harrison, 1991). Generally, smokers have a poorer sense of smell than non-smokers. This is, among others, caused by the fact that smoking causes a poorer circulation of blood in the mucosa and as a consequence thereof, in the nasal mucosa as well. Just as any other organ, the olfactory organ is influenced by aging as well. Around the age of 30 years the sense of smell is optimal, and after the age of 65 signs of degeneration become apparent. This phenomenon is also referred to as presbyosmia (Van Toller and Dodd, 1987). As a consequence of this degeneration process, 75% of people over the age of 80 lose their sense of smell completely (Doty, 1991). Some environmental substances, like gasoline, acetone and ammonia, also negatively influence the sense of smell. Exposure to such substances may harm the sense of smell and cause a decreased sense of smell (Hastings and Miller, 1997). Persons belonging to occupational groups often in contact with these substances, such as painters and employees of gas stations, may therefore have a decreased ability to smell. Usually, women are better at smelling and are usually better in identifying odours.

Apart from these four factors, everyone goes through periods of a temporarily decreased sense of smell, for instance due to swollen nasal mucosa during a cold. A decreased sense of smell can also be caused by numerous other disorders.

Olfaction disorders can be either perceptive or conductive. A perceptive smelling disorder is caused by deviancies of the neurological structures, such as the olfactory epithelium, the olfactory bulb and the cerebral nerves, involved in the process of smelling. These types of smelling disorders are usually irreversible. Only in perceptual smelling disorders caused by deviancies of the olfactory epithelium, may the sense of smell return, since the olfactory epithelium is able to regenerate. Causes of perceptual smelling disorders may be, for example, trauma, damage by chemicals, Parkinson's disease and Alzheimer's disease. A conductive smelling disorder is caused by obstruction of the orthonasal airflow. This may be caused by a deviated nasal septum, swollen nasal mucosa, or nasal polyps. This type of disorder can usually be solved through the use of medication or surgery (Broek and Feenstra, 1995). Both perceptive and conductive smelling disorders can exist in various stages. The following terms are used in describing these stages (Vissing et al., 2001):

Anosmia: the inability to perceive odour sensations;

Hyposmia: a decreased ability to perceive odour sensations;

Hyperosmia: an increased ability to perceive odour sensations;

Smell agnosia: the inability to identify or classify a perceived odour sensation.

The term *normosmia* is used to refer to an adequate sense of smell.

Smell and taste are related and deviancies leading to a tasting disorder are usually actually smelling disorders. True tasting disorders are rare, mainly due to the widely spread localizations and extensive neuronal innervations of the taste buds. Because of the direct relationship between taste and smell, the terms used to describe taste disorders are given below as well:

Ageusia: the inability to perceive flavour sensations;

Hypogeusia: a decreased ability to perceive flavour sensations;
Hypergeusia: an increased ability to perceive flavour sensations;
Taste agnosia: the inability to identify or classify a perceived flavour sensation

The influence of olfaction disorders

Apart from the various scientific terms used for anosmia, there are no common terms for the inability to smell or to taste. For the loss of other sensory functions the common terms deaf, numb and blind exist. The diversity of the consequences of a decreased sense of smell is often unclear, especially for people who are able to smell. In a study by Van Toller (1999), 94 students were asked which sense they could most easily miss. Seventy-eight percent of this group chose the sense of smell. The sense of smell seems then to be the least appreciated sense and is then most probably the most underestimated sense. Olfaction disorders, however, influence various aspects of daily life. What those aspects are and how they are influenced is described below, using the theory of Abraham H Maslow (1908-1970). This American psychologist states that human needs, for example food, warmth and acceptance, follow a hierarchy (figure 4). The higher needs cannot be fulfilled and are of no importance as long as the lower needs remain unfulfilled (Maslow, 1954).



Figure 4. Maslow's pyramid of human needs.

A decreased or nonexistent sense of smell is considered to affect the different levels of human needs as follows (Van Toller, 1999):

Physiological needs

Smell and taste are related. With a decreased or nonexistent sense of smell, the sense of taste decreases as well. In the absence of a sense of smell, certain drinks and foods lose a large part of their taste, some up to even less than 10% of their optimal value (Mozell, 1969; Engen, 1982). This also causes a decreased production of saliva and other gastric secretions. Also, eating and drinking is less enjoyable when the sense of taste is decreased. In that case it is difficult to obtain the necessary nutrients.

Sex also belongs to the physiological needs category. Those parts of the brain responsible for the sensation of smell are linked to parts of the brain of the endocrine system involved in sex and eroticism. Apart from that, there is also a link between the olfactory organ and those parts of the brain essential for sexual behaviour, such as the expression of emotions, swelling of genital organs and the orgasm (Vroon et al., 1994). Odours influence sexual lust and activity; people who are anosmic often report a decreased sexual interest (Tennen et al. 1991; Van Toller, 1999). Sexual behaviour also influences the perception and processing of odours, most likely due to hormonal changes caused by sexual behaviour (Stoddart, 1990). This is a complex mechanism, which is actually even more important and obviously present in animal behaviour.

Safety needs

The decreased ability to detect warning odours such as gas and smoke increases feelings of danger and fear. This may manifest itself in an excessive checking of gas, of smoke detectors or candles. The olfactory organ is also the most important organ in the selection of food and the detection of spoiled food. Foods may seem delicious, but when the smell is bad, we usually will not eat it.

Belongingness, and love, esteem and cognitive needs

Lacking information, which others have, may cause social insecurity, which may lead to feelings of social isolation. This is the case for many sorts of information, not in the least for information about odours. This is especially the case when it appears that this phenomenon is inconceivable to others and thereby not understood.

The sense of smell plays an important role in various psychological processes and behaviour. For instance, the perception of unique personal odours of people is of importance in making and maintaining social networks (Vroon et al., 1994).

The influence of odours on our frame of mind is well known and often used by shopping malls by spreading certain odours said to provoke people into buying. The perception of certain odours influences mood (Van Toller, 1999).

The perception of our own body odour is of great social importance. The decreased ability or inability to perceive one's own body odour may cause insecurity. This may lead to excessive use of perfume or aftershave and excessive showering or cleaning.

The lack of odour sensation in people that are anosmic or hyposmic may then lead to dejection and depression.

Aesthetic needs

The large numbers of perfume stores, the sheer endless number of articles available, as well as their price, are good indications of the importance of such products for many.

Self-actualisation

People who are anosmic or hyposmic are not suitable for jobs in which smell is of importance. Specific professions, such as that of cook, vinologist, or employee of a perfume store, need an adequate sense of smell. Sense of smell is also related to memory and is therefore important in some learning processes (Mozell, 1971; Laing and Willcox, 1983; Laing and Francis, 1989). The absence of the sense of smell could thus hinder the development of certain possibilities.

Notwithstanding the drawbacks, which have been mentioned, in some situations the inability to smell can also be advantageous. This is, however, less advantageous than it may seem: people who are normosmic usually have the choice to smell or not to smell.

II. Smelling after total laryngectomy

Total laryngectomy

Total laryngectomy is a surgical procedure during which the entire larynx, consisting of the hyoid bone, the epiglottis, the thyroid cartilage, the cricoid cartilage, the laryngeal strap muscles and the first two or three tracheal rings are removed. The larynx separates the respiratory and the digestive tract and consequently, after removing the larynx, the two tracts must be reconstructed to preserve their functions. This is why during the operation the trachea is bent forward and sutured to the skin of the neck, which has been fenestrated for that purpose. This more or less round, percutaneous opening is the tracheostoma, the entrance to the trachea. After surgery the patient will thus breathe through this tracheostoma. The digestive tract is reconstructed by suturing the pharyngeal musculature and mucosa formerly attached to the dorsal side of the larynx. For some patients the resection must be more extensive, leaving too little or even no pharyngeal tissue for primary closure of the pharyngeal defect and restoration of the digestive tract. Then, tissues from elsewhere in the body will be used for reconstruction: this may be skin or muscles from the chest, arm or leg, or even part of the stomach or jejunum. The respiratory tract and the digestive tract are thus, with or without the use of tissues from other parts of the body, permanently separated. The respiratory tract becomes a separate route from the tracheostoma in the neck to the lungs, while the digestive tract from mouth to stomach remains as it was. The route of the respiratory tract is not the only change following total laryngectomy. All other pre-operative laryngeal functions such as manner of phonation, voice-sound, coughing, sneezing, straining, blowing and smelling alter as well. A total laryngectomy thus has many diverse consequences.

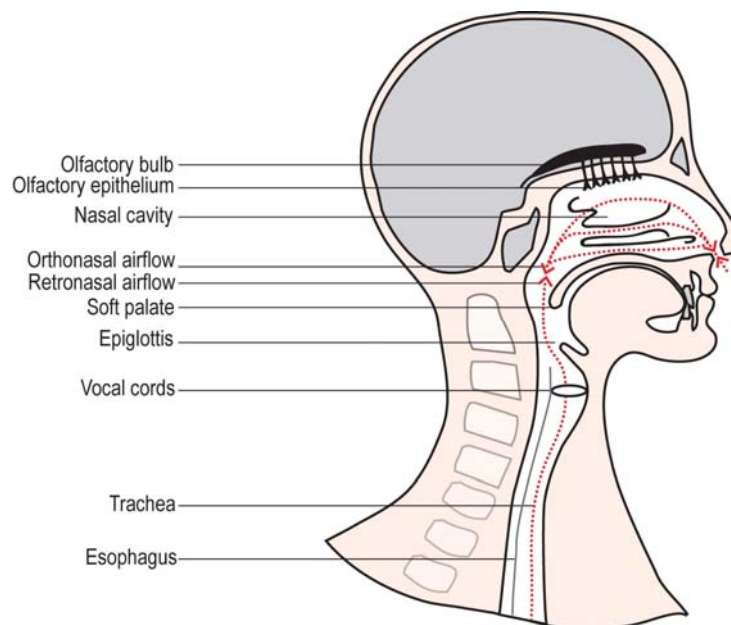


Figure 5. Schematic drawing of the anatomical situation before total laryngectomy

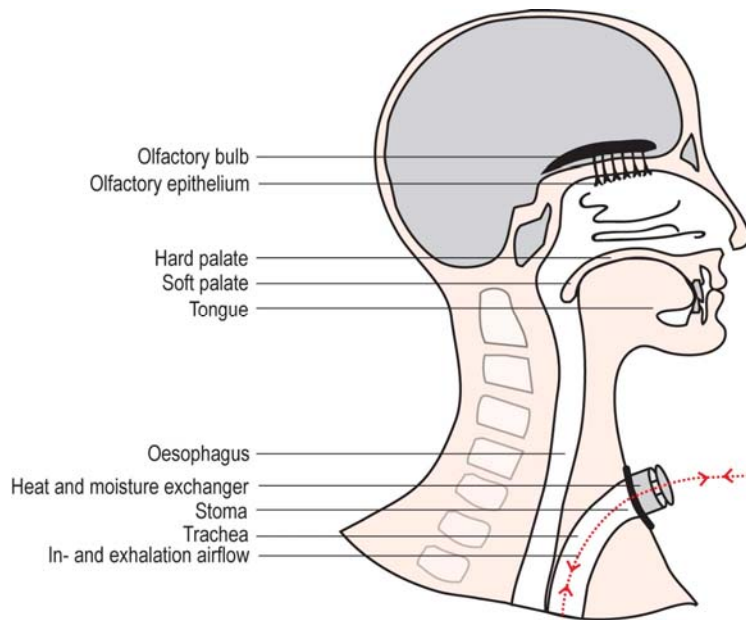


Figure 6. Schematic drawing of the anatomical situation after total laryngectomy

Indications for total laryngectomy

The first total laryngectomy for cancer was carried out in 1873 by the famous Viennese surgeon Billroth (Gussenbauer, 1974). Nowadays, this surgery is still being carried out. In the Netherlands, every year, approximately 250 patients are laryngectomized (Ackerstaff et al., 1990). In few cases severe dysphagia or laryngeal fractures may be indications for this type of surgery. Laryngeal carcinoma is the most frequent cause for carrying out a total laryngectomy. Also hypopharyngeal carcinoma can be an indication for total laryngectomy. Not every patient with a laryngeal or hypopharyngeal tumour will require total laryngectomy. Only larger (T4¹) tumours and recurrent laryngeal and hypopharyngeal tumours following radiotherapy are treated with a total laryngectomy. In males the laryngeal tumour will usually be detected between the age of 50 and 70, in females usually 5-10 years earlier (Visser et al., 1998). The percentage of males with laryngeal carcinoma is higher than the percentage of females, although the number of females with this type of carcinoma is increasing. This increase is mainly due to changes in lifestyle. Smoking and alcohol consumption are the main risk factors to develop laryngeal carcinoma (Berg, 1996). Inhalation of co-contaminants like asbestos or exposure to radioactivity are also factors of which relationships to laryngeal cancer have been suggested (Wynder et al., 1976; Hinds et al., 1979; Burch et al., 1981; Muscat and Wynder, 1992; UICC, 1997; Trigg et al., 2000).

¹ 1 An international classification system is used in oncology to determine the stage of malignant growths, called carcinomas. This is the TNM system. The letters stand for tumour, nodus and metastasis (Ferlito, 1993; UICC, 1997). For each patient the size of the tumour, the size of possible metastases in lymph nodes and the possible presence of distant metastases can be measured using numbers between the three letters. This is called staging.

Anatomical changes, olfactory changes

A total laryngectomy does not affect the anatomy of the nose and the olfactory epithelium. Although patients more often complain about a 'runny nose' following total laryngectomy, olfaction is preserved. The function of the olfactory epithelium also remains unchanged, even when it has not been used for some time (Moore-Gillon, 1985; Tatchell et al., 1985; Mozell et al., 1986; Welge-Luessen et al., 2000, Fujii et al., 2002). Since laryngectomized patients do not breathe through their nose anymore, both the orthonasal and retronasal airflow decrease. This influences the sense of smell negatively, and also, but to a lesser degree, the sense of taste (Henkin et al., 1968). Involuntarily, odours might be 'blown' into the nose, which may cause an odour sensation in laryngectomees. Also strong, volatile or irritating (trigeminal nerve) odours may be perceived by laryngectomees. Thus, the substantial decrease in the perception of odours after a total laryngectomy generally is mainly caused by the absence of nasal airflows. In the section *Olfaction disorders* in the previous chapter, four factors that influence the sense of smell are described. Those four factors are smoking, age, environmental factors and gender. These factors are also related to laryngeal carcinoma, as described in the former section. Laryngectomees are often former smokers, which also negatively influences the sense of smell. Laryngectomees are often of older age, and therefore age related decrease of the sense of smell is to be expected. Inhalation of harmful substances is harmful to the sense of smell and is also suggested as playing a role in the development of laryngeal carcinoma. There are more male than female laryngectomees and generally males have a poorer sense of smell than females. In summary, it can be stated that in laryngectomees a perceptual smelling disorder, apart from hyposmia based on the absence of nasal airflows, may commonly exist.

Rehabilitation of olfaction

Shortly after surgery, the loss of the sense of smell may for many laryngectomees be of less importance than other consequences of the total laryngectomy, such as the presence of a tracheostoma and changes in the voice. However, as described, the sense of smell plays an important role in many aspects of daily life. This is reason enough to give each laryngectomee, qualified to receive training, the attention this subject it deserves. In the past, some options have been suggested on how to improve olfaction after total laryngectomy. One of these suggestions was the use of a larynx-bypass (Mozell et al., 1983; Bosone, 1984; Tatchel et al., 1985; Mozell et al., 1986; Swartz et al., 1987; Knudson and Williams, 1989). A larynx-bypass is a tube between the tracheostoma and the mouth (see figures 7 and 14), re-establishing a connection between the upper and lower airways. This enables breathing in through the nose and thus allowing olfaction to take place in a more or less normal manner. However, this solution is not very practical; one must perform a number of actions before one can actually smell. Talking and eating are not easily combined with smelling in this way and consequently the use of a larynx-bypass does not improve the sense of taste. Since the larynx-bypass is not used throughout the entire day, but only when there is a reason to smell, its use does not restore the warning function of odour perception. Moreover, it is a rather eye-catching instrument. Nevertheless, the larynx-bypass is a very useful device for research purposes. The latter is described in more detail in following chapters.

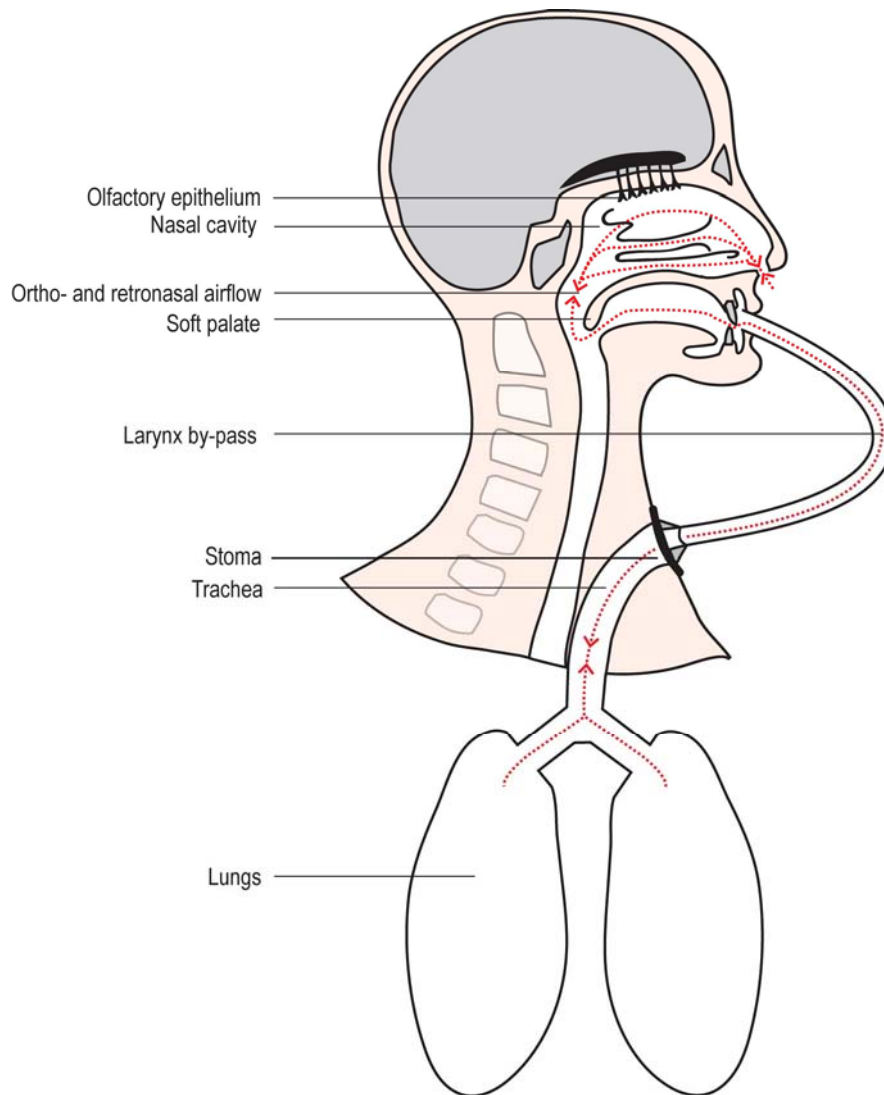


Figure 7. Schematic drawing of a laryngectomized patient using a larynx-bypass

More methods generating a nasal airflow are described. Examples of this are the glossopharyngeal press (Damsté, 1979), buccopharyngeal sniffing (Moore-Gillon, 1985), and the buccopharyngeal manoeuvre (Swartz et al., 1987). Most of these methods propose the generation of retronasal airflow by creating pressure changes in the pharynx. These methods have not been described in detail and their effectiveness has not been proven in scientific studies. Hence, they have not been used in general practice and remain fairly unknown.

III. Olfactory rehabilitation: Polite yawning technique

The most drastic consequences of a total laryngectomy, such as changes in vocal and pulmonary function, are nowadays addressed by adequate rehabilitation devices (Hilgers and Ackerstaff, 2000). Since a study concerning physical and psychosocial consequences of total laryngectomy by Ackerstaff et al. (1994), the attention for deterioration of olfaction and gustation after total laryngectomy has increased. This study showed that deterioration of olfaction and gustation is a frequently occurring problem following total laryngectomy: 52% of the patients reported a partial or complete loss of the sense of smell and 15% of the patients reported a decreased sense of taste. Those findings have been studied in more detail since 1997 (van Dam et al, 1999ⁱ, Hilgers et al., 2000ⁱⁱ; Hilgers et al., 2002ⁱⁱⁱ). The first study investigated deterioration of olfaction and gustation after total laryngectomy and observations were carried out to investigate why some patients were better able to smell than others. Based on the observations of the techniques that laryngectomees taught themselves in order to be able to smell, the Nasal Airflow Inducing Manoeuvre (NAIM), or so-called 'Polite Yawning Technique' was developed. This technique induces orthonasal airflow and is described in detail below.

Polite yawning technique

Polite yawning describes the basis of this technique. The oral cavity should be enlarged a couple of times (yawning), by lowering the mandible, floor of mouth and tongue. When this is done while keeping the lips securely closed (polite yawning), an underpressure exists in the oral cavity and, consequently, air is drawn into the nose: orthonasal airflow. This airflow carries the odour molecules to the olfactory epithelium and thereby leads to olfaction.

Yawning is usually combined with elevation of the soft palate. However, if the technique would be carried out with an elevated palate, the nasopharynx would be closed and no orthonasal airflow could be created. When someone yawns with open mouth, breathing takes place through the open mouth and the soft palate indeed is elevated. However, during polite yawning, with the lips closed, the soft palate is lowered, and breathing consequently takes place through the nose.

The polite yawning method is built on the following basic assumptions:

- The mandible, and thus the floor of mouth, is lowered. The mandibular joint rotates, but should not shift;
- Simultaneously, the tongue moves from the hard palate downwards;
- The lips remain closed;
- The movement must be repeated quickly a couple of times;
- While performing the movements, relaxed breathing should continue and the breathing rhythm should be independent of the movements of the mandible and tongue;
- The movements must be performed eutonically, thus not hypokinetically, and certainly not hyperkinetically.

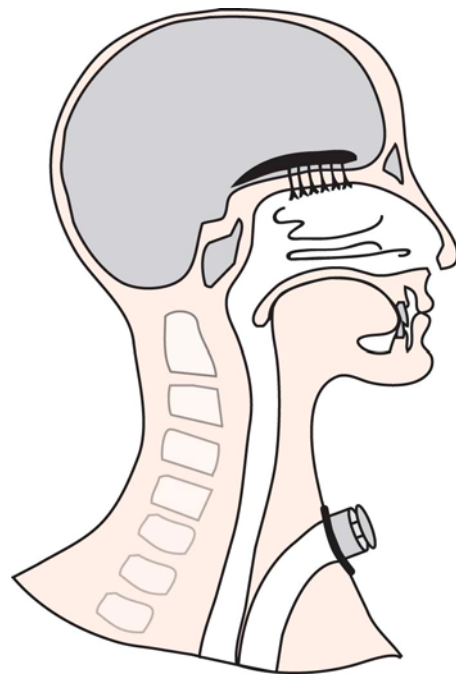


Figure 8. Schematic drawing of the starting point of the polite yawning technique

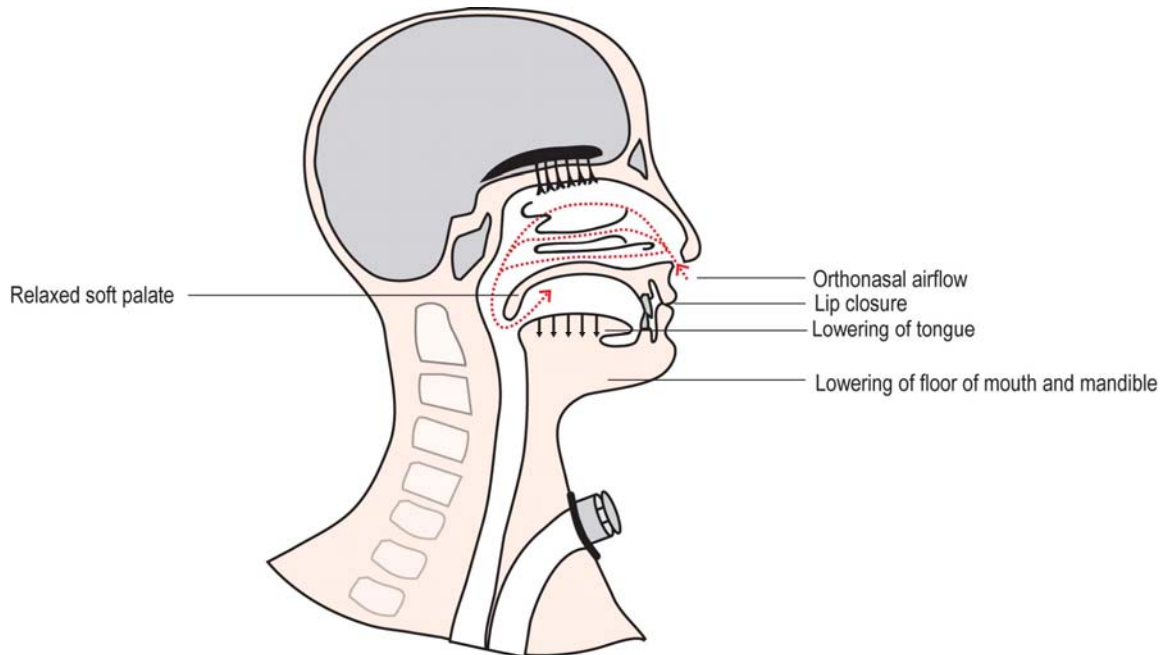


Figure 9. Schematic drawing of the anatomic situation while performing the polite yawning technique.

The Speech-Language Pathologist (SLP) should be able to perform this technique correctly before it can be taught to a laryngectomized patient. For a non-laryngectomee it is, however, more difficult to perform the polite yawning technique correctly, without creating airflow by the regular breathing method. By closing the vocal folds, comparable

to closure of the vocal folds when straining, the airflow can be prevented. In that way, the anatomical situation after total laryngectomy is approached as nearly as possible. When the method can be performed adequately, the next step is to try to make the movements smaller. It will then become less obvious to the environment that the patient is trying to smell. This less obvious method will be called the “refined polite yawning technique” in the remainder of this manual. To whom, how, and when the (refined) polite yawning technique can be taught, is discussed in the following sections of this chapter.

Polite yawning technique and SLP treatment

Patient selection

It would be most unfortunate for laryngectomized patients if, besides the loss of the voice box, they also unnecessarily lose the function of the most prominent part of the face. In principle, every laryngectomized patient with a reasonable to good sense of smell, who is also motivated to use this optimally, should be given the opportunity for olfactory rehabilitation using the polite yawning technique. Even when the patient’s sense of smell is not optimal, olfactory rehabilitation should be considered in order to restore the remaining olfactory function optimally.

In case of doubt about the patient’s olfactory function, a smell disorder can be established or ruled out with an odour test combined with a larynx-bypass. This is described in the section [Odour tests](#) of this chapter and the section [Laryngectomy and olfactory disorders](#) in Chapter 4.

For patients with limited cognitive function, not offering olfactory training may be considered. These patients may find that carrying out the different parts of the technique simultaneously is not possible, and reproducing and using the method may be difficult. With the exception of those few extraordinary cases, each laryngectomee is in fact suited to training of olfaction. Even patients who have undergone a total laryngectomy combined with a total glossectomy have shown themselves capable of acquiring the polite yawning technique and demonstrated improved olfactory function. See also the section [Organic handicaps](#) of Chapter 4.

Patients with dentures that do not fit optimally may have problems using the polite yawning technique. When practicing the dentures can be taken out but, consequently, in daily life the patient probably won’t use the technique. It is therefore recommended that these patients be advised to visit a dentist for a correct fitting of the dentures.

The polite yawning technique was originally developed for laryngectomized patients. Apart from this patient group, this technique may also be useful for tracheotomized patients. Those patients still have their larynx, but various anatomical or functional reasons may be the cause of the necessity for the patient to breathe through a cannula placed in a percutaneous opening into the trachea. A tracheotomy will be situated under the larynx, usually in between the second and third tracheal ring. When the patient occludes the cannula he can breathe nasally, allowing for smelling. Patients, who are permanently ventilated through their tracheotomy, for instance following high spinal lesions, may however have difficulty occluding their cannula due to pareses and ventilator equipment attached to the cannula. Those patients are, just as laryngectomized patients, hyposmic due to the absence of orthonasal airflow when the cannula is not closed. Those patients could also benefit from using the polite yawning technique.

Treatment

The greatest achievement to be obtained with rehabilitation of olfaction is that the laryngectomee is able to smell with the refined polite yawning technique and that its use becomes automatic, used frequently during the day. Some patients need quite some time to achieve this goal, while others are able to imitate it correctly immediately after explanation by the SLP. Also, there are some patients who develop their own technique in order to be able to smell, even before they hear about the polite yawning technique. Even for these patients, some explanation may be valuable. They may learn to use the technique more consciously and therefore obtain more control over their sense of smell. Due to these differences amongst patients, the duration of the treatment is highly variable.

For patients needing more time to acquire the technique, it is advised that the polite yawning technique be practiced for a short amount of time during a number of subsequent therapy sessions. The entire therapy session does not need to be used for olfactory rehabilitation.

A large number of patients require post-operative radiation therapy; this period of time can be used for rehabilitation of olfaction. These patients are usually somewhat more fatigued and voice rehabilitation may be difficult as well. During this time, practicing the polite yawning technique may be a welcome 'breezier' intermission.

If olfactory rehabilitation is not successful, due to a lack of motivation on the part of the patient, or the inability to carry out the various movements, the treatment should naturally be discontinued.

Group treatments have shown a low success rate. Differences amongst patients are large, especially in the movements they make. Giving each separate patient in the group the specific directions required at the moment they need it is next to impossible. Even training two patients at the same time is more difficult than two individual training sessions, both for the SLP and the patients. However, one should realize that there are also patients, who, in contrast, may be more motivated during group training.

Rehabilitation of olfaction involves various aspects requiring special attention. On the CD-rom a [Checklist for the SLP](#) can be found, which may be useful at the beginning of training. The checklist gives an overview of the aspects to be addressed during training.

Rehabilitation of olfaction, pre-operative

If olfactory rehabilitation is included as a part of the complete rehabilitation program following total laryngectomy, the patient should be informed of the preliminary loss of the sense of smell and its later rehabilitation early on in the process. Besides all other consequences of total laryngectomy, the consequences and possibilities for olfaction should already be discussed during the pre-operative visit. First, the reason why the sense of smell is decreased after surgery should be explained. Figures 5 and 6 may be used for this purpose. The SLP should also check with the patient how he thinks his sense of smell is at that moment. Testing olfactory acuity with an odour test helps to find more objective answers to these questions. Unfortunately, it is not always possible to carry out an odour test pre-operatively. Patients may have difficulty concentrating, because they are nervous for the surgery or do not feel well. In those cases, the opinion of the patient on his sense of smell will have to suffice. Conducting a pre-operative odour test is, however,

preferred. If the (test) results show that the patient has a good sense of smell, the SLP should discuss the polite yawning technique with the patient. She/he should point out that this technique will allow restoration of olfaction after surgery and she/he should let the patient know at which point in time rehabilitation will be started. It is not necessary to give detailed information about the use of the technique at that point. It should also be stated that the sense of smell never will be as passive as it was before surgery. In order to be able to smell, the polite yawning technique will have to be carried out actively. If the odour test shows that the patient is already hyposmic or anosmic before surgery, it is advisory to let the patient consult an otolaryngologist. An otolaryngology examination may clarify the reasons for the smell disorder and some sort of treatment may be started.

Odour tests

For various reasons, an odour test is the necessary starting point for rehabilitation of olfaction. Ideally, for patients who will be taught the polite yawning technique immediately during the post-operative period, the same odour test should be carried out at three points in time: pre-operatively, post-operatively and at the end of the olfactory rehabilitation. Pre-operatively, the test is used to establish if and how well the patient is able to smell. Post-operatively, this should also be established as well as observing the personal/instinctive technique that the patient uses to smell. This enables better fine-tuning of the rehabilitation suited to the individual patient. After rehabilitation, test results can be compared in order to evaluate the intervention. The results of the odour tests can be administrated on the [Registration form](#), which can be found on the CD-rom. In patients who were laryngectomized some time ago, only two odour tests should be performed: before olfactory training and when the training has been finished. If the pre-intervention odour test raises doubt about the sense of smell, it is advisable to use a larynx-bypass during the test. If the patient is able to smell with the larynx-bypass, he is a suitable candidate for olfactory rehabilitation. If the patient seems anosmic, even with the use of the larynx-bypass, it is of course not advisable to start olfactory rehabilitation. An examination by an otolaryngologist should be carried out in order to establish the cause of the anosmia.

There is a wide range of odour tests available. They have usually been developed to test olfaction in non-laryngectomized individuals with olfaction disorders. Those tests are usually expensive, perishable and complicated in their use. The Zürcher Geruchstest is an odour test that has proven to be useful for the otolaryngology and SLP practice for use in laryngectomized patients (Briner and Simmen, 1999; Hilgers et al., 2002). This odour test consists of eight smell diskettes, enabling assessment of a patient as normosmic, hyposmic or anosmic.

If no odour test is available, an odour test may be assembled. Suggestions on how to do this are to be found in a separate file [How to design an odour test](#) on the CD-rom. Such a homemade odour test is referred to as an odour assessment. An odour assessment is obviously not suitable for diagnosis. It is, however, obviously more of an objective assessment of the results for rehabilitation than the patient's own opinion. Also, it enables observation of the personal technique the patient uses to smell. Nonetheless, a validated existing odour test is preferred above a homemade odour assessment.

Olfactory rehabilitation, post-operative

Immediately following surgery, in most cases, voice rehabilitation, swallowing and fitting devices for rehabilitation such as voice prostheses and Heat and Moisture Exchangers (HMEs) are given priority. When the patient is sufficiently comfortable with these changes, rehabilitation of olfaction will be started.

In some cases rehabilitation of olfaction may be started earlier or later in the post-operative period. For instance, when there are post-operative fistulas preventing the start of voice rehabilitation and swallowing, olfactory rehabilitation may be started already. On the other hand, olfactory rehabilitation can even be started years after surgery without any problem.

The sense of smell is usually only appreciated after its loss (Van Toller, 1999). It is therefore of utmost importance to give a clear explanation about the cause and, more urgently, the consequences of hyposmia after total laryngectomy. Post-operative rehabilitation of olfaction starts with this explanation. This information, which has previously been spoken of briefly with the patient before surgery, is preferably given in the presence of family or relatives. First, it is necessary to explain that breathing will not take place through the nose any longer and that the sense of smell has therefore decreased. The anatomical differences are shown in figures 5 and 6. The various aspects influenced by the loss of the sense of smell can be discussed with the patient with the help of Maslow's pyramid, as described in the section [Olfaction disorders](#) of Chapter 1. After discussing these aspects and answering any possible questions of those present, the odour test, which was performed pre-operatively, should be carried out again. The odour test should also be carried out at this point when the surgery took place some time ago and no pre-operative test was carried out. The test results are the starting point for the intervention.

During the test procedure, techniques used by the patient in order to smell should be observed. Frequently the patient will be observed to be breathing in through his stoma in order to smell something, or that the odour is being moved back and forth in front of the nose or stoma. It may also be observed that the patient already makes movements comparable to the polite yawning technique. The technique used by the patient during the test is discussed with the patient afterwards.

Teaching the polite yawning technique

After discussing the personal technique of the patient, the polite yawning technique should be compared to the own technique. The various movements of the method are mentioned and demonstrated by the SLP. Then, the patient is asked to imitate the technique, if necessary using a mirror. If the patient already demonstrated a fairly correct technique during the odour test, this can be used as a starting point giving some instructions for change. If the patient experiences difficulty carrying out some movements, and there are no clear anatomic causes for this, specific exercises for those isolated movements may be used. Some examples of these types of exercises are described in Chapter 4, which also contains directions for treatment of patients with anatomical constraints.

When the isolated movements can be carried out correctly, they can be combined with the other movements of the polite yawning technique. As soon as the patient is capable of

carrying out the polite yawning technique correctly, it should be practiced and optimised with the use of a manometer, as described in the next section.

Manometer as training aid

A manometer is an indispensable device for olfactory rehabilitation, both for the patient as well as the SLP. The figures in this manual and the video clips on the accompanying CD-rom show a special manometer, made of Plexiglas tubes. Suggestions for a simpler homemade version of this instrument are given in the file ([How to make a manometer](#)) on the CD-rom.

A manometer enables easy judgment of the generation of a nasal airflow in relation to the movement that the patient is carrying out. The amount and direction of movement of the fluids in the manometer give direct visual feedback. It also helps in providing insight into possible causes of an incorrect performance of the polite yawning technique.

Before use, fill the manometer with water, approximately to the lowest indicator.

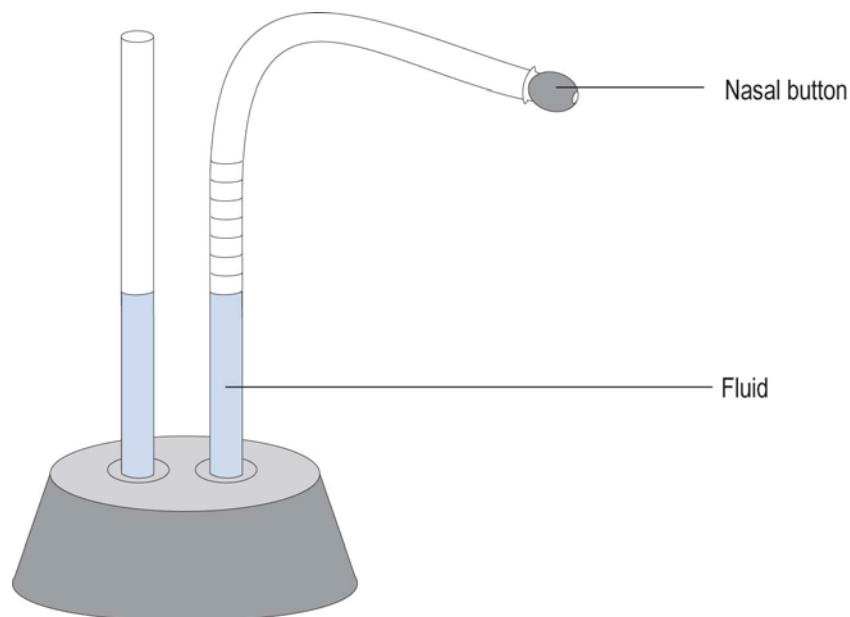


Figure 10. Manometer filled with fluid.

Instead of water a coloured fluid can also be used in order to enhance visibility. However, this may cause colouring of the manometer tubes, which subsequently might cause a decreased visibility. The nasal button attached to the end of the flexible tube must be held against one nostril, keeping it closed off from the outside air. It is important to check whether the opening in the nasal button is free in the nasal cavity and not occluded by the nasal septum or nasal concha. A finger must close the other nostril, since nasal airflow will otherwise be generated there as well. This airflow will reduce the displacement of the fluid in the manometer. When the nostril is closed correctly, the polite yawning technique can be carried out. This is done correctly when the fluid in the manometer moves towards the nose of the patient.

The passage of the nostrils, also called nasal cycle, changes in most humans every couple of hours. At a certain point in time, one nostril is more open than the other (Hasegawa

and Kern, 1977; Eccles, 1978; Broek and Feenstra, 1995). Therefore, it is advisable to try both nostrils when using the manometer in order to identify the most open one, which should consequently be used during practice.

Obviously, closing one of the nostrils is of course only necessary when practicing with the manometer. When the polite yawning technique is used normally to smell this will not be necessary.

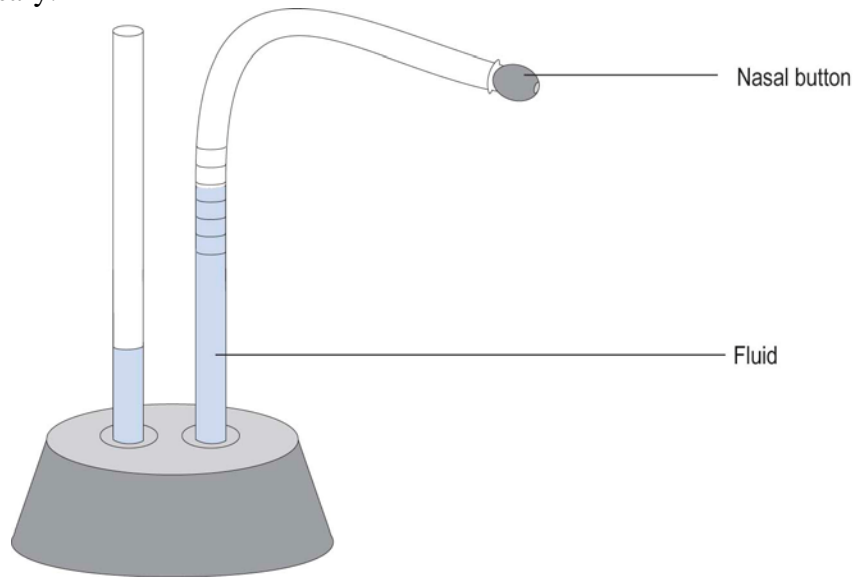


Figure 11. Correct movement of the fluid in the manometer.

At first, when practicing the most important objective is to have the fluid move in the right direction. Then, it is important that this movement is repeated frequently, the fluid should fluctuate up and down regularly and evenly. Subsequently, the emphasis is on enlarging the magnitude of replacement of the fluid with the lowest possible effort. Finally, the patient should be able to carry out the movement correctly without using the manometer, and automatically. Only then, will the patient benefit optimally from the polite yawning technique. In order to give the patient the opportunity to reach this goal, it is advisable to allow the patient to take the manometer home to practice. In this manner the patient obtains visual feedback in the absence of the SLP and can achieve the correct technique independently.

Before the patient is given the manometer to take home, it should be clear how to use it and the patient should be able to make the movement more or less correctly. The patient should not take the manometer home when he/she:

- Has reduced cognitive abilities, like Korsakov's Syndrome or Alzheimer's disease. Moreover, in those cases it is questionable whether it is useful to start olfactory rehabilitation at all;
- Carries out the movement hyperkinetically;
- Has a disorganized breathing pattern or a breathing pattern synchronous to the polite yawning movement;
- Does not make any movement at all or a makes a completely incorrect movement.

In order to optimise independent practice by the patient with the manometer, this ‘book’ encloses a [Patient manual](#), which may be printed as a separate PDF file from this CD-rom. If the patient makes use of both the manometer and the patient manual, practice of the polite yawning technique is easier and acquisition of an incorrect technique is prevented. It is advisable to explain the content of the brochure to the patient and highlight parts important for the individual patient. At the end of the brochure there is some room, which may be used for specific points of attention. The patient is of course advised to contact the SLP if there are any problems acquiring the correct technique. If the patient fails to move the fluid in the manometer at all, or moves it in the wrong direction, the instructions given in the section [Difficulties with the manometer](#), in Chapter 4 may be helpful.

Frequently patients will habitually breathe in deeply in an attempt to smell. Before surgery, this was the natural way to provoke an odour sensation: this was how orthonasal airflow was formerly generated. Despite the fact that in theory it is not very likely that the fluid in the manometer will move in the right direction when the patient is breathing in – breathing in through the stoma after all does not generate orthonasal airflow – in practice it may happen. This phenomenon, observed in few patients, is caused by the anatomical situation (Kirchner et al., 1963). When breathing in, the thoracic cavity expands. This causes negative thoracic pressure, which causes the oesophagus to open. This opening of the oesophagus causes an inward airflow, which, if the mouth is closed, enters the nose: orthonasal airflow. It is thus possible that the fluid in the manometer moves towards the nose of the patient when breathing in deeply and that, consequently the patient also is able to smell upon deep inhalation. It may then seem to the patient that the movement is being carried out correctly, since the water is moving in the right direction. It is, however, important that this exaggerated breathing is discouraged since it may cause hyperventilation. Suggestions on how to overcome this problem and how to handle in case of hyperventilation are given in the paragraph on [Functional problems](#) in Chapter 4. Also keeping the water up high in the manometer for some time, by keeping the mouth and pharynx in the ‘yawn-position’ is useless. Although the ability to do so shows that the patient voluntarily controls the method, it does not generate sufficient airflow. Still-standing fluid means no airflow and thus no smell sensation.

Finally, it is very important that the patient realizes that olfaction will never become something as passive as it was before the total laryngectomy. No amount of practice will ever be enough to ensure automatic olfaction; the patient will always need to perform the polite yawning technique in order to smell something.

Odours to practice with

If the fluid in the manometer moves correctly and the polite yawning technique is performed eutonically, the next step in the rehabilitation procedure can be taken: the actual smelling of odours. Odours used during olfactory rehabilitation will be referred to as practice odours. Practice odours are indispensable during this intervention: learning to smell without odours is like learning to swim without water. After the patient has acquired the technique using the manometer, the technique should of course become functional. That is often more troublesome than it may seem, as it is initially illogical for the patient to use a movement of the oral cavity in order to smell. Many laryngectomees,

therefore, are still tempted to breathe in through their stoma as soon as they attempt to smell the practice odours. Especially for patients who were laryngectomized some time ago and who have developed their own technique over the years, it may be difficult to smell the practice odours using the correct technique. They will first have to “unlearn” their old habits, before they will be able to use the new.

Ethereal odours are useful as practice odours, but also strong smelling daily life products such as coffee, tea with a clear aroma, peppermint, cinnamon, and vanilla can be used. Odours used in the odour test or odour assessment should not be used as practice odours. The odour test used would then become unreliable for evaluation of treatment.

When using the manometer it is advisable to close one nostril. As mentioned earlier, when attempting to smell and when practicing with the practice odours, obviously the nostril should no longer be closed. Both nostrils can then contribute to the sense of smell. In this way the normal manner of smelling is approached as closely as possible. Only when patients wish to smell something very clearly and precisely, may the closing of one of the nostrils be useful.

When practicing olfaction with the practice odours, the patient will often be unable to name the odour. This will be the case even when the odour is perceived and appears to be familiar. This phenomenon is also seen in non-laryngectomees. Different theories exist to describe the reason for this difficulty in naming odours. It may be caused by the phenomenon that emotion (including the sense of smell) and language (including naming things) are usually not localized in the same hemisphere of the brain (Vroon, 1989; Vroon, 1992; Vroon et al., 1994). In addition, some odours may appear strange in a practice context. For instance, the smell of chocolate is not directly what one would expect to smell coming out of a bottle with clear fluids in the practice room of the SLP. This makes naming an odour more difficult. In the patient’s daily life scents will usually not be perceived in this manner, in fact, it is usually the opposite. The patient sees something she/he would like to smell and then carries out the polite yawning technique and recognizes the smell. The odour, which is perceived, resembles what the patient has expected to smell, and naming the odour is then not as much an issue.

Initially, when practicing, the most important point is whether the patient smells something at all. Subsequently, the patient may try to classify odours. This comes down to naming the type of odour, such as sweet, fresh, dull or flowery.

Refined polite yawning technique

When the patient is able to perform the polite yawning technique correctly and it is a functional exercise, therapy can then focus on trying to make the movement as small as possible and thus as inconspicuous as possible. This can be done by repetitive movements of the base of the tongue only, instead of moving the entire tongue. If this is carried out correctly, this minimal movement should be sufficient in creating orthonasal airflow. Depending on the patient’s usual tongue position at rest, the tip of the tongue should remain fixed against the alveolar ridge or against the gums under the lower teeth when performing the tongue pump technique. It is best when the teeth remain clamped shut and the base of the tongue consequently moves from the roof of the mouth downwards. By eliminating the movement of the mandible, the movement becomes rather limited and thereby barely noticeable to others. Only an insignificant upward and downward motion of the floor of mouth will be detected when the refined polite yawning technique is

performed correctly. The movement of fluid in the manometer will indicate if the tongue movement is correct and sufficiently efficient.

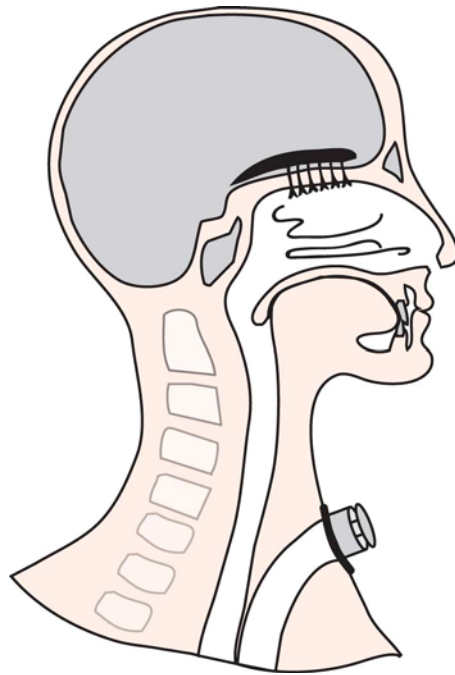


Figure 12. Starting point for performing the refined polite yawning technique.

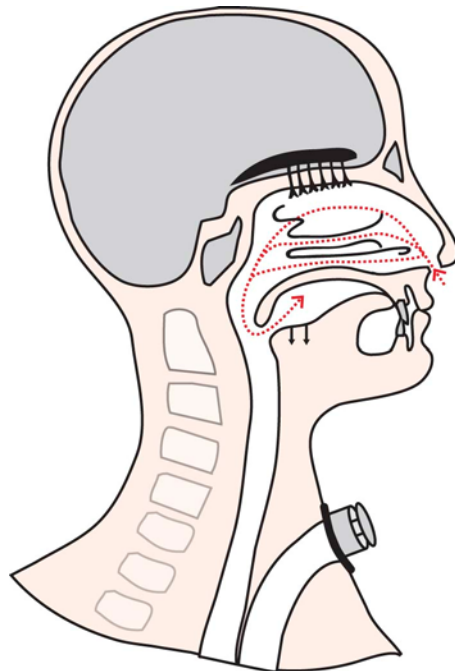


Figure 13. Movement of the tongue and floor of mouth during 'refined polite yawning'.

The refined polite yawning technique may be difficult for some patients, for example those with a decreased ability to move parts of the mouth due to fibrosis or oedema. Furthermore, the base of the tongue is not clearly visible and therefore mostly a subconscious entity for many patients. These aspects may play a role in the fact that learning the smaller movement may be difficult or even impossible for some patients. In such cases, the basic polite yawning technique should suffice.

Specific extra exercises for the base of the tongue may help to increase control over the tongue. See Chapter 4, [Guide for specific situations](#).

Rehabilitation usually begins with teaching the polite yawning technique because it is easier to learn by the obvious visibility of the movements. It goes without saying that patients who are able to make the correct movements for the refined polite yawning technique from onset do not have to start the rehabilitation with learning the basic movements.

Improving taste

The olfactory organ plays a leading role in the smell process, but is also of importance for taste. Retronasal airflow is also an essential factor in sensing flavours. Laryngectomees still experience this airflow, unlike orthonasal airflow, but it is limited. Breathing out no longer happens via the nose. Retronasal airflow is still generated while eating and swallowing, by movement of the tongue necessary for displacement of food and swallowing (Burdach and Doty, 1987). If the patient suffers from hypogeusia it may be advisable to have him/her use the tongue more actively during eating. Moving the tongue towards the roof of the mouth will create retronasal airflow. This tongue movement, in fact the opposite of that used during the polite yawning technique, is actually the most suitable.

Laryngectomees are usually oncology patients. It may be so that for this patient group the taste is not or insufficiently improved by a conscious effort to use the described tongue movement. This may be caused by a (temporary) taste disorder brought on by chemotherapy and/or radiotherapy. To help these patients to make eating an enjoyable process, they should be advised to concentrate on the basic taste groups of sweet, salt, sour and bitter. Consciously experiencing the colour, structure, temperature and spiciness of a dish, together with the physical presentation of the food may help improve the attractiveness of eating for these patients (Van Toller, 1999).

Automating

When the laryngectomee has full control over the polite yawning technique and he is able to smell and classify the practice odours, he will need to use this (or the refined technique) in daily life. Using the technique in authentic daily situations will help implementation into the actual daily life. This is the only way that the warning function of olfaction can be rehabilitated and that smelling will most resemble the situation prior to surgery. This may be achieved by using the polite yawning technique regularly at certain points of time during the day. For instance, every time the patient enters a different room, or every time he meets another person.

Final phase of treatment

When the patient has learned to use the polite yawning technique and possibly makes use of the refined technique and is able to use this in everyday situations, the treatment will be finalized. The final phase consists of repeating the previously used odour test. The scores of the three tests, pre-operative, post-operative and final test will be compared and the result of the rehabilitation will be evaluated with the patient. Naturally, the aim is to achieve a score in the odour test, which is comparable to the pre-operative score.

The patient should be stimulated to continue using the polite yawning technique as much as possible in his daily life, so that this process becomes more of an automatism. This should imitate as much as possible passive smelling from before the surgery. Learning processes, such as the learning process of the polite yawning technique, may be modelled according to the following levels (O'Connor, 2001):

1. Unconscious – unable
2. Conscious – unable
3. Conscious – able
4. Unconscious – able

Level 1 is the situation directly following the laryngectomy and preceding the olfactory rehabilitation. The patient may smell something but he does this unintentionally or incorrectly. Perhaps he only takes deep breathes to smell. This was the way the patient smelled before surgery and he is therefore not conscious of the fact that this habit is no longer suitable. He does not realize that he does not smell properly: olfaction is unconscious and unable.

At level 2 after explanation of the polite yawning technique by the SLP, the patient realizes that the own method to smell is not the most efficient. The patient knows that what he is doing is incorrect: conscious and unable.

The next level is the conscious-able phase. The patient now knows how to use the polite yawning technique. With concentration and effort the patient can use the method correctly. The patient can do this initially with help from the manometer and later using the practice odours.

The final aim is level 4: the patient is able to make the movements automatically and unconsciously during the entire day. At this point the polite yawning technique is almost equivalent to previous passive smelling as in non-laryngectomized individuals. Smelling has become an automatic and properly performed action: unconscious and able.

Between level 3 and 4 the rehabilitation treatment will usually be rounded off. Although this is the usual final point, one should realize that this is a crucial moment. The patient is capable of using the polite yawning technique and he can use it to smell, but its use is anything but self-evident. It is very important that the technique be done unconsciously. Experience has shown that patients will discontinue use of the technique if it continues to be difficult and requires too much attention. When the rehabilitation has reached its final phase, the patient should therefore be stimulated to continue using the polite yawning technique to help make it an automatic action and thereby optimising it. In this manner the technique does not remain an exercise, but a way in which smelling once again will be a normal part of the patient's life.

IV. Guide for specific situations

Laryngectomy and the common cold

A laryngectomized patient with a cold will have symptoms dissimilar to non-laryngectomees. They will normally sneeze differently and less often, and they do not feel they have a stuffed nose. In this way, it is difficult to figure out if they are dealing with a cold or not. Due to the swelling of the nasal mucosa, which is exhibited by both laryngectomees as well as non-laryngectomees, nasal airflow is reduced and thereby olfaction is also reduced (Huttenbrink, 1995). Hyposmia is then a result of a conductive disorder. When the laryngectomee, who is learning to smell, has more nasal mucus than normal, has perhaps an altered taste, is unable to get the manometer moving, smells less after the larynx-bypass (even though he never previously complained of hyposmic or anosmic problems), then we may be dealing with an olfaction disorder due to a common cold. The otolaryngologist may determine endoscopically with more certainty the origin of the hyposmia in such cases. If the problem is actually a common cold, the otolaryngologist may prescribe a nasal spray to decrease the swelling of the nasal mucosa, thereby aiding passage through the nose.

Laryngectomy and olfactory disorders

Laryngectomees may have olfactory disorders, which people with a normal anatomy also have. To prevent endless endeavours teaching the patient the polite yawning technique without result, olfactory disorders must be diagnosed in an early stage. The diagnosis during the pre-operative interview and the odour test help to recognize existing olfactory disorders.

If olfaction seems to have worsened post-operatively, then a larynx-bypass may help determine the state of olfaction for the patient (see figures 7 and 14a and b). A larynx-bypass connects the tracheostoma to the mouth, and thereby the nose to the lungs, so that the patient may breath through his nose again, as he did prior to the total laryngectomy.



Figure 14 a: laryngectomee with larynx-bypass fixed in peristomal adhesive.
Figure 14 b: laryngectomee with larynx-bypass with cap over tracheostoma.

A larynx-bypass should therefore make it possible for the patient to smell effortlessly again. If the patient is able to smell odours of the odour test using this aid, then he should also be able to smell using the polite yawning technique, because perceptive or conductive olfaction disorders have been ruled out.

Some patients are unable to breathe with a larynx-bypass and thus are also unable to evoke orthonasal airflow. In such a case, an odour may be introduced into the nasal cavity using a soft squeezable bottle or spray to test whether the patient is anosmic or not.

If the patient smells nothing when using a larynx-bypass, bottle or spray, then the probability is high that he/she has an olfaction disorder. Olfaction using the polite yawning technique will most likely be unsuccessful. In these cases it will be necessary to send the patient to an otolaryngologist for further tests and possible treatment. If the otolaryngologist has established a permanent anosmia, rehabilitation of olfaction is impossible. The anomaly in the olfactory organ or one of the other structures responsible for olfaction precludes that any olfaction rehabilitation program might be successful.

Difficulties with the Manometer

When the polite yawning technique is not optimally performed, the fluid in the manometer will move not at all, very little, or incorrectly and the patient will be unable to smell anything. What exactly can go wrong and what can be done to correct it is described in the following paragraphs.

Stationary liquid

When fluid remains stationary, there is no orthonasal or retronasal airflow. Attempt to use the other nostril first to see if there is any improvement. Usually stationary fluid is caused by the absence of tongue movements or by defective tongue movements. To improve tongue movements, make use of the exercises in the paragraph [Functional problems](#), in this chapter. The soft palate may be inflexible if the patient makes the tongue movements too tightly, causing blockage of the airflow. Lack of nasal airflow may also be caused by a poor closure of the lips. If the liquid remains stationary, a conductive olfactory disorder may be the cause. This must always be considered. The larynx-bypass may be useful in proving this.

Minimal movement of liquid

If the opposite nostril is not closed, there will be some difficulty in getting the fluid to move. It is therefore suggested that when using the manometer, the nostril be closed. Tongue movement may also be responsible for minimal movement of the liquid, especially if the movement is made with little effort. The liquid in the manometer will move upwards into the direction of the nose, but only minimally. The patient should practice further moving the fluid upwards every time. This can only be achieved by using more powerful and active movements of the tongue. Specific tongue exercises may help in this, as well. Hyperkinetic movement of the tongue must be avoided. The lips should also be closed constantly.

Extra pressure may be created by allowing the patient to breathe in, occlude the tracheostoma and then perform the polite yawning technique. Usually the liquid in the manometer will then move further upwards. Non-laryngectomized individuals are able to make the same movement by breathing in and then holding their breath. This method is only useful in helping the patient most efficiently to learn the technique with the manometer, as closure of the tracheostoma to actually smell something in daily life is not a practical option.

Incorrect movement of liquid

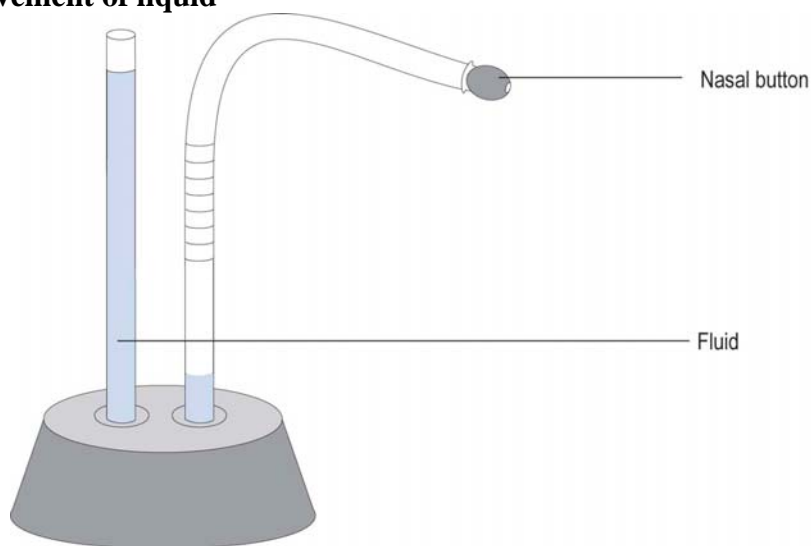


Figure 15: Manometer in which liquid moves incorrectly

If the liquid in the manometer moves away from the patient (see figure 15), this may be caused by retronasal airflow due to the tongue being pushed upwards instead of it being pulled downwards. This may be changed when the patient learns the correct starting point for the tongue. This is when the entire tongue is pressed against the roof of the mouth. At this point a slight intake of breath is required. The entire tongue must then be moved downwards in one movement. The tongue must then return to the starting position almost effortlessly. Then the movement may be repeated.

Organic handicaps

Often the liquid in the manometer does not move correctly or a patient is unable to smell using the polite yawning technique due to an incorrect execution of one or more of the steps in the method. The cause may be organic or functional. Following are a few tips and exercises to improve certain parts of the polite yawning technique. Functional problems will be better tackled than those of an organic nature using these exercises. In the case of organic problems, it is extremely important that the patient learns to make the movements as correctly as possible in spite of the disorder. This may be attained by compensational tactics. For each individual patient it must be determined which tips and exercises are best for his situation and in which order they should be offered.

Facial paralysis

Unilateral facial paralysis may cause a dysfunction of the muscles around the mouth and of the muscles of the cheek of that side of the face. Patients with this type of paralysis may find it difficult to keep the lips closed while moving the mandible. These patients may find it easier to make use of the refined polite yawning technique. Using this method, only the back of the tongue is moved, making it easier to keep the lips closed. For these patients it may be better to omit the standard polite yawning technique. If the refined polite yawning technique is too difficult for the patient, he/she may wish to consider manually keeping the lips closed.

Glossectomy

Although the tongue plays an important role in the polite yawning technique, it is not indispensable. There are a few patients who have had a total laryngectomy as well as glossectomy and are still able to perform the polite yawning technique with success. By keeping the lips firmly closed and using the remaining musculature of the oropharynx and mouth still enough underpressure can be built up. To prevent disappointment, these patients should be explained before rehabilitation that total restoration of olfaction is not guaranteed using the polite yawning technique. Because the tongue is missing, these patients must learn compensating strategies using other musculature, which requires great concentration and often a lot of practice.

For these patients, practice with the manometer is often more important than instructions on how to perform the polite yawning technique itself. Standard explanation of the technique is obviously not applicable to this small group of patients. The patient him/herself can discover what he/she must do to create orthonasal airflow, using the manometer. Showing the patient the floor of mouth movement (such as visible during the refined polite yawning technique), may help the patient at this point. When this movement can be made, the patient should practice gaining control over the altered area

in the mouth and throat so that the method may be performed without use of the manometer. The patient may be advised to “think about yawning” and “act as though you are sucking in through a straw, while the lips remain closed”. This may help the patient to get an idea of which movements should be made and how he/she can make them.

Trismus

If the patient is unable to open the mouth properly, therapy may be needed preceding olfaction rehabilitation. If, however, the patient is able to move the tongue correctly, this may be sufficient. In this case the patient should omit the polite yawning technique and start immediately with the refined technique.

Functional problems

Breathing

When attempting to smell, many laryngectomees will breathe in, out of habit. If these patients are taught the polite yawning technique, breathing in will usually be synchronized with enlargement of the mouth. To prevent hyperventilation, the intuitive coupling of breathing and olfaction by polite yawning should be broken. The breathing rhythm, therefore, should not be synchronous to the mandibular and tongue movements. Usually the patient is unaware of the frequency of breathing movements when exercising the polite yawning technique. Often it is sufficient to focus the patient’s attention on this fact to get the rhythm slowed down. If a simple explanation is insufficient to induce a relaxed breathing pattern, it may be necessary to practice by holding the breath by temporarily occluding the tracheostoma. The patient will then experience the possibility of exercising the method independent of breathing. Following this, the patient may agree to breathe in only at the moment an SLP has given a signal to do so. Finally, the patient should practice the method often so that this signal becomes superfluous.

Hyperkinesis

In the case of voice disorders, a hyperkinetic use of musculature can be treated. This can also be done in case this happens during the polite yawning technique. First, the patient should be made aware of the tension often found in the muscles used for chewing and in the tongue musculature and the soft palate. These muscles should be made obvious to the patient. Following this, muscle tension should be controlled. This may be exercised, for example, by building up muscle tension and then letting loose totally. This release of tension will ultimately have to be reached in order to make the necessary movements. Association of the polite yawning technique with chewing movements will often lead to a reduction of the muscle tension. See also the comments made in paragraph *soft palate*, in this chapter.

Hypokinesis

A deficiency in muscular strength when performing the polite yawning technique is only a problem if this is a deficiency in the tongue musculature. Making a clicking sound with the tongue is often sufficient, as this creates a certain tension. Naturally, the patient should learn to make as little noise as possible when performing the polite yawning

technique. Otherwise an attempt to smell will not only be visible, but audible as well. Patients often experience this as deviant behaviour, leading to disuse of the technique.

Hyperventilation

Patients, who combine breathing with the polite yawning technique too intensely, might start hyperventilating. A carbon dioxide deficiency may result, leading to higher adrenaline production (among others). The patient may then complain of heart palpitations, tingling, claustrophobia, headache, dizziness, nausea, and pain in the chest. To prevent this, the methods described in the paragraph *Breathing* may be practiced.

What to do when hyperventilation does occur:

- When hyperventilation occurs, place a bag in front of the tracheostoma and allow the patient to breath into it. When the patient subsequently breathes in the carbon dioxide rich air, which he/she has just breathed out, the carbon dioxide level in the body will rise.
- Attempt to return to regular breathing by counting along with the patient. Try to have him breathe in for 3 seconds and out for 6 seconds. Pause for one second after breathing out. For example: one-two-three-out-two-three-four-five-six-and-in-two-three-out-two-three-four-five-six-and-in-two-three-out-two...etc.
- It may help to distract the patient. The patient may be asked to read aloud, write something down, or think of as many odours as he can.

Jaw-relaxation

Opening the mouth may be difficult for patients, especially in combination with closure of the lips. In this case the polite yawning technique may be too difficult. However, if there are no organic disorders to hinder the mouth opening, it is possible to perform jaw-relaxation exercise. This exercise should be attempted first in front of a mirror to increase the body consciousness. When this exercise can be carried out correctly without use of a mirror, the following exercises should be done with a mirror again.

1. Allow the mouth to fall open and then close it. Repeat this movement a few times. Do not allow the movement to become hyperkinetic. The movement should be made eutonically. Accent is on the opening of the mouth, and not the closure. Be careful that the jaw joints are not protruding when the mouth is in the open position, to prevent cranio-mandibular dysfunction. The patient can keep an eye on this in the mirror. The patient may also lay his middle and forefinger on the joint of the jaw to control and correct the movement when necessary. When the patient is able to make the movement correctly, the visible and manual aids should be discontinued.
2. Allow the patient to make a movement as though he is chewing on something extremely large. He should make this movement with his mouth and lips closed, again in front of a mirror. If the results are unsatisfactory, allow the patient to chew on something real such as an apple or cracker. This allows the patient a realistic experience opening the mouth with the lips closed.
3. Ask the patient to imitate your example of a yawn. Follow this with an example of “polite yawning” with the lips closed. Again ask the patient to imitate this movement.
4. Movement of the mandible may be linked to articulation of the ah-sound.

5. Allow the patient to repeat “maa-maa-maa”, until he is aware of the [m] sound as being bi-labial.
6. Ask the patient to keep the lips firmly closed while making the ah-sound. The correct jaw movement will then be made. It will seem as though the patient is chewing on something large while keeping the lips closed. Most likely the patient will keep his tongue flat on the bottom of his mouth. To smell, the patient will also need to activate the tongue.

If these exercises are insufficient in leading to an improved polite yawning technique, the refined polite yawning technique should be attempted. With that technique it is not necessary to open the mouth. Only movement of the base of the tongue will then be required.

Tongue (base)

The basis of the polite yawning technique is the pumping movement of the tongue. Often this is the most difficult aspect of the technique as the tongue movement is not visible while the lips are closed. During the polite yawning technique the entire tongue should move. During the refined polite yawning technique, only the base of the tongue and the base of the mouth move. The following exercises should help the patient understand the proper movements necessary for the techniques. These are only suggestions as there are far more suitable exercises available.

1. Allow the patient, in front of a mirror, to press his tongue firmly against the palate to experience this sensation. If the patient has dentures, do this exercise at first without the dentures in to optimise the sensation. If the patient is unable to move the tongue towards the roof of the mouth even with the use of a mirror, a wet cotton swab may be used to stimulate the hard palate. Usually the tongue will then automatically move to the roof of the mouth to remove or decrease the tickling feeling. Another method is to allow the patient to suck on a flat candy, to help the tongue to move to the roof of the mouth. Subsequently, practice in front of the mirror will help the patient move his tongue without the aid of a candy. Finally the patient should be able to make the movement with his mouth closed without the use of aids.
2. Ask the patient to move his tongue upwards against the hard palate, using a sucking movement.
3. Ask the patient to suck his tongue against the hard palate, and release it with a clicking sound.
4. Same as 3, except now with the mouth closed.
5. Practice repeating these movements of the tongue.

Using the refined polite yawning technique, the first 2 points may be done similarly. Continue the exercise in the following manner:

1. Allow the patient to suck his tongue against the hard palate and release it with a clicking sound, while keeping the tip of the tongue in place and the mouth open. This is more difficult than when the mouth is closed.
2. Same as 1, but keeping the lips closed. Only the floor of mouth will move visibly.
3. Practice repeating these movements of the tongue.

Soft palate

If the patient performs the movements in a strained manner, then it may be that the velum is tensed. This makes it impossible to create a nasal airflow. Movement of the fluid in the manometer is then not possible, as is olfaction. The patient will have to work on attaining an eutonic performance of all the movements. If this is insufficient in attaining a relaxed velum, then the patient should try making a nasal sound (preferably the [m] because the lips are then closed), while performing the polite yawning technique to aid in relaxation of the velum. Suggestions such as “pretend to smell something”, “sniff in the air” and “think about breathing through your nose” may help in this case as well.

Some additional suggestions for hyposmia and anosmia

Sometimes, despite all efforts of the patient and the SLP, rehabilitation with the polite yawning technique cannot be completed successfully. In such a case, the patient could be shown a few tricks to provoke some type of artificial airflow in order to still smell something in certain conditions, should that be necessary. Movements of air using the hand or a handheld ventilator to move air towards the nose are two such methods. Use of a larynx-bypass may also be considered.

For laryngectomees, who are really anosmic, the situation is somewhat different. As mentioned earlier, olfaction is of great importance in daily life, especially socially. People who are no longer able to smell and thereby have a decreased sense of taste are significantly handicapped. Anosmic laryngectomees who are having trouble with the fact that they will no longer be able to smell should be told of the existence of ‘Anosmic Societies’, which are active in different countries. Patient counselling and support are worthwhile activities of these societies. The sense of smell will not be restored by these activities, but such a society can be helpful to develop coping strategies for this handicap. It is not advisable to send laryngectomees with a decreased sense of smell ‘only’ based on the absence of an orthonasal airflow to such an Anosmia Society. Obviously, they are better off with the ‘normal’ Laryngectomee Societies

Conclusion

Total laryngectomy is a radical and mutilating operation. Fortunately, these patients often have a long life expectancy and there are many advanced medical aids/devices to decrease the burden of their handicaps. The rehabilitation process for these patients is demanding, but obviously of great significance. Sufficient attention should be given to all the functions that permit rehabilitation so that the patient can live an optimal life, relatively free of the restrictions as a consequence of the operation. No longer being able to smell at the moment one wishes is such a restriction, at the least. The polite yawning technique has proven a suitable method in attaining an optimal sense of smell for a large group of laryngectomees. Hopefully, SLPs will become more aware of this method and incorporate this in their rehabilitation program in such a way that laryngectomees can regain some of their nose function. This will help them return to a situation that we so take for granted.

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Endnotes

Following are the summaries of the three publications concerning the research on olfaction of laryngectomees in the Netherlands Cancer Institute.

Van Dam, F.S.A.M., Hilgers, F.J.M., Emsbroek, G., Touw, F.I., Van As, C.J. & De Jong, N. (1999). Deterioration of olfaction and gustation as a consequence of total laryngectomy. *Laryngoscope*, 109: 1150-1155.

Introduction: After total laryngectomy the absence of a nasal airflow results in a decrease in olfaction and perception of flavours.

Material and Methods: Odour perception was assessed in 63 laryngectomized patients with two different olfactory tests. The methods used by patients to smell were observed during olfactory testing. Patient's judgment about their olfaction and gustation was assessed by means of a structured questionnaire, semi-structured interview, and self-rating.

Results: Based on the results of the olfactory tests, patients were categorized as "smellers" and "non-smellers". Approximately one third of the patients were able to smell the odorous substances used in the olfactory tests. The smellers more often used a variety of methods to smell than the non-smellers ($P < .002$); in most patients the method consisted of active use of facial muscles. Patients appeared well able to judge their own odour perception. Compared with the smellers, the non-smellers judged their odour perception as worse ($P < .003$) and reported a more severe decrease in gustation after the operation ($P < .033$). The results of this study in laryngectomized patients confirm the interrelation between olfaction and gustation: the non-smellers reported a poorer gustation and a more severe decrease in gustation and appetite than both the smellers and a reference group of elderly persons ($P < .05$). Patients who reported a deterioration of olfaction and gustation tended to experience negative consequences such as the inability to smell smoke, leaking gas, or agreeable odours.

Conclusion: Olfaction and odour-related flavour sensation are seriously deteriorated after total laryngectomy.

Hilgers, F.J.M., Van Dam, F.S.A.M., Keyzers, S., Koster, M.N., Van As, C.J. & Muller, M.J. (2000). Rehabilitation of olfaction in laryngectomized patients by means of a Nasal Airflow Inducing Manoeuvre: the 'Polite Yawning' technique. *Archives of Otolaryngology - Head and Neck Surgery*, 126: 726-732.

Objective: To develop a nasal airflow-inducing manoeuvre and apply it in the olfactory rehabilitation of patients who have undergone laryngectomy.

Design: Intervention study; before-and-after trial.

Setting: National cancer centre.

Patients: Forty-four patients who underwent laryngectomy; 34 men and 10 women; mean age, 64 years (range, 42-80 years); mean time since surgery, 6 years (range, 8 months to 18 years).

Intervention: In a prospective clinical intervention study, we assessed the effectiveness of a nasal airflow-inducing manoeuvre ("polite yawning," i.e., yawning with closed lips). Speech therapists trained the patients in the manoeuvre, and its effectiveness in inducing

nasal airflow was checked with digital and water manometers.

Main Outcome Measures: Olfactory acuity was assessed before and after the intervention by means of an odour detection test and a structured questionnaire concerning olfaction, taste and appetite. Patients were categorized as “smellers” or “non-smellers” on the basis of the results of the odour detection test and the present odour perception scale derived from the questionnaire.

Results: The nasal airflow-inducing manoeuvre could be taught to all patients, mostly in only one 30-minute therapy session. Fifteen of the 33 patients in the pre-treatment non-smeller category converted to smellers, for a success rate of 46% ($P < .001$).

Conclusion: The nasal airflow-inducing manoeuvre (the “polite yawning” technique) allowed almost half of the patients to recover their sense of smell.

Hilgers, F.J.M., Jansen, H.A., Van As, C.J., Polak, M.F., Muller, M.J. & Van Dam, F.S.A.M. (2002). Long-term results of olfaction rehabilitation using the Nasal Airflow Inducing (‘Polite Yawning’) Maneuver, after total laryngectomy.

Archives of Otolaryngology - Head and Neck Surgery, 128 (6): 648-654.

Objective: To study in laryngectomized individuals the long-term results of the Nasal Airflow-Inducing Manoeuvre (NAIM) as an olfaction rehabilitation tool, and to investigate the effectiveness of a new, simpler odour test (Zürcher Geruchstest; ZGT).

Design: Intervention study.

Settings: National cancer centre.

Patients: Forty-one laryngectomized individuals who received olfaction rehabilitation training from 4 months up to 2 years earlier with the NAIM. This so-called ‘Polite Yawning’ manoeuvre creates an under-pressure in the oral cavity, which, in turn, generates a nasal airflow enabling odour molecules to reach the olfactory epithelium again.

Main outcome measures: Olfaction acuity testing with a standard odour detection test (ODT), with a questionnaire, providing a subjective olfaction score (‘Present Odour Perception Scale’; POPS), and with the ZGT; assessment of the patients’ correct execution of the NAIM by Speech-Language Pathologists (SLPs) on video recordings made during odour testing; and assessment of olfaction acuity long-term.

Results: The correlation between the previously used ODT/POPS combination and the ZGT was $r = .563$ ($P < .001$). Based on these results we preferred to use the much simpler ZGT instead of the laborious combination of the ODT/POPS. Based on the ZGT results, 46% of the laryngectomized individuals were ‘smellers’ and could be considered normosmic. There was a significant relation ($P = .028$) between the patients’ correct execution of the NAIM and whether or not the laryngectomized individual was a ‘smeller’ according to the ZGT.

Conclusions: The effectiveness of the Nasal Airflow Inducing Manoeuvre (NAIM), or so-called ‘Polite Yawning’ technique, for the rehabilitation of olfaction in laryngectomized individuals could be reconfirmed. The long-term olfaction rehabilitation is achieved in about half of the patients, but more intensified training may be needed to increase the percentage of successfully rehabilitated individuals. The ZGT is an effective and simple test for the assessment of olfaction acuity in laryngectomized individuals.