

## Olfactory System as a Sensory Tool in Treatment

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I'm not talking about Aroma therapy. I'm talking about using basic things you can find in your kitchen or garden. Cinnamon, curry, chocolate, basil and cilantro are a few of my favorites. In the Occupational therapy setting the use of smell as a sensory modality, has been shown to be a useful therapeutic tool. I have personally been using it to:

- improve attention and focus skills via midline orientation
- encourage turn taking, social/emotional interactions and emotional stimulation
- develop nasal breathing and breath awareness for relaxation, calming and self regulation
- desensitize the picky eater or persons with hypersensitivities to smell

So why is it underutilized?

I was first introduced to using smell with geriatric patients, as an Occupational therapy student back in the 1980's during one of my clinical internships. It was used to alert patients and invoke positive memories and sharing in our groups. The use of smell can be used throughout the lifespan as an aid in therapy with a variety of patients whether it is those with physical, mental or developmental disabilities.

### Attention Getting

In my current practice, I have used olfactory stimulation to regain group attention and focus in my children's yoga group sessions. These children who have a variety of developmental challenges including autism spectrum disorders and sensory processing concerns, when presented with olfactory stimulation respond immediately, where verbal or visual cues are less effective. The midline orientation helps to refocus the children, and the emotional response to the stimulation gets a quick reaction of focus, attention, sharing and social responses and dialogue. Since the children have a desire for "a turn" in the group and took turns taking sniffs it encouraged turn taking, waiting and attending.

### Nasal Breathing and Self-Calming

A big focus in a yoga group has always been on the poses and postures of yoga for improving strength, coordination, body awareness and balance, but it is through the breathing exercises that clients learn to relax, pace and find calmness. Through the olfactory system, I begin to teach nasal breathing and breath awareness. One exercise is called "flower breath". Once the child understands the concept of smell, you do not need to have an actual flower, scent or something to smell. They are asked to pretend by taking a nasal breath in and slowly exhaling through their mouth at first. With practice, the exhale is later taught to be performed through the nose which is more calming. Arm movements such as bringing hands towards nose and mouth on inhale and extending arms either forward or out to sides with the exhale can be performed with the breathing exercise. With the experience of smelling, children can then engage in taking a "flower breath" anytime during the day as a way to calm, self-regulate, transition between activities and just refocus and get centered. This is an easy exercise that can be taught to teachers for use during transitions such as lining kids up to go to/or from Music, PE, recess or for calming before a test.

### Sensory Integration for Picky Eaters

Olfaction, taste and trigeminal receptors together make up flavor. Our tongues can distinguish our main qualities of taste (sweet, sour, bitter, salty), but our noses can distinguish hundreds of smells. It is during the exhalation of breath that the olfaction contribution to flavor occurs in contrast to that of proper smell which occurs during the inhalation phase.  
(2)

During individual sessions, I have been utilizing the sense of smell with patients who are picky eaters and/or hypersensitive to smells. Using common household ingredients can affectively stimulate the olfactory and taste systems. I usually present smells in old spice jars, film containers and small bottles. Examples have included: coffee, ginger, mint, nutmeg, lemon, garlic, onion, and cocoa. Fresh fruits work well and provide both an olfactory and tactile experience. I

start off with presenting only 2-3 scents in a session, but take the child's lead if more will be presented in the session. Some children are sensory seekers and will request to smell more. In children who are verbal, discussion on foods and smells can then take place. As a precursor to feeding therapy, it is effective in desensitizing and allowing the child to be more receptive to trying new foods. In sensory integrative treatments, I have used olfactory stimulation while a child is engaged in a vestibular or "happy" activity to integrate more positive connotations with food smells. Positive emotional experiences when paired with smell, give that smell a positive connotation, as noted in research performed at Brown University. Their findings indicated that when a neutral odor is paired with an emotional event, the perception of that odor was altered to fit that association. An example noted is that Americans, tend to like the smell of wintergreen, a common ingredient in candy and gum but in Britain, where wintergreen is often used to make medicine, the odor is less pleasing. The study found smell is learned and not just a matter of genetics. (1)

This has strong implications for therapists that work with patients with feeding issues, mental health issues and during cooking sessions in a physical rehabilitation setting.

Not only is there a connection between smell and taste (2, 7) but new findings indicate that there is a sound/smell connection as well. (2, 3, 4). Perception of a smell is increased when presented together with a sound; as noted in spikes in activity at the olfactory tubercle, an area of the brain where smell is processed. The activity was significantly higher when the sound was presented than when just the smell was presented alone.

## HOW DOES IT WORK? WHY DOES IT WORK?

The olfactory system is quite complex and consists of many synapses and processes. There is still much we don't understand about how this system processes information and its influence. Externally we start off at the nose, where smell enters the body and interacts with cilia and smell receptors sending the signal via the 1st cranial nerve (peripheral nerve system) to the olfactory bulbs for processing. There are two olfactory bulbs; one for each nostril. Inputs from the two nostrils are processed separately just like input from our eyes. (6) From the bulbs, messages are relayed to the central nerve system and to the cortex. When information goes to the cortex, it moves via both ipsilateral and contralateral pathways with synapses at the thalamus and hypothalamus. This connection to the limbic system is involved with mood, motivation, memory and neuroendocrine regulation. The limbic connection is responsible for the emotional

component of smell. (7) Olfactory information is processed in five major regions of the cerebrum: the anterior olfactory nucleus, the olfactory tubercle, the amygdala, the piriform cortex, and the entorhinal cortex. (See chart below). Every smell is coded, the experience is put in long term memory for retrieval and the context plays a part in the emotional connotation that smell will take on.

The olfactory limbic system is an old system that existed and evolved over 450 million years ago. Its importance to survival, fight and flight responses in early creatures and more currently in learning and memory should not be underestimated. (8) Its influence is often subconscious.

What would first alert us to a fire in the next room; vision, hearing or smell?

## NOSE

- Receives input that interacts with cilia, mucous, and smell receptors and sends information to the CNS via Cranial nerve #1.
- Input is then transmitted to the **Olfactory bulbs**.
- And then relayed through the CNS via ipsilateral and contralateral neural pathways.
- Synapses occur in the **thalamus** (dorsomedial nucleus) and **hypothalamus** before processing in five main cortices.
- Anterior Olfactory (Nucleus) Cortex processes olfactory information but is not fully understood.
- Olfactory Tubercle is where sound/smell multi-modal processing occurs. (4)
- Amygdala (limbic system) is involved in emotional/social influences and responses to stimuli.
- Piriform Cortex (temporal lobe) is involved in identifying smells.
- Entorhinal Cortex is involved in memory and associations.

Chart 1. Simplifies but demonstrates the various pathways involved in Olfactory processing.

## PRECAUTIONS:

Only food and safe sources of smells should be used for olfactory stimulation. Stimulation should be a quick sniff of less than a few seconds, unless of course it is something being cooked, in which case the smell may linger for longer i.e.

bacon, micro waved popcorn, etc. Over stimulation or negative reactions can be noted by signs of watery eyes, rapid breathing, rapid heart rate or other signs of stress; a pulling away or a refusal should be respected. Essential oils and other aroma therapy modalities should only be used if you have been trained in their use as they are very potent and can be dangerous if used incorrectly.

Scientific research is beginning to back use of aromatherapy for many conditions. (9)

You should also be aware of any allergies your patients may have or of others in your facility. Some allergic reactions can be severe.

The Alliance for Consumer Education (ACE) reports more than 1,400 inexpensive and readily available products are part of an inhalation abuse problem in this country. Air fresheners should not be used or encouraged to be smelled even if TV ads encourage it. They are part of the many commonly used products such as felt tipped markers, correction fluid, nail polish remover, computer dust removal sprays, hair spray, pressurized dessert toppings, spray paint, glue, butane lighters and cooking spray that are "huffed" or "sniffed" by children to achieve short-term highs. These compounds can cause irreversible damage to the brain, heart, lungs, kidneys, liver and even death."

Please visit the ACE website to find out more about this problem. <http://www.inhalant.org>

### **SUMMARY AND CONSIDERATIONS:**

Olfactory stimulation is a sensory modality that is often under-utilized but research is showing it is a sensory component to treatment that can be effective with many patient populations. It influences learning, memory and motivation. Olfactory stimulation helps:

- Improve attention skills.
- Elevate or influence mood.
- Teach nasal breathing for self regulation and calming.
- Desensitize picky eaters to food smells and improved taste perception.
- Stimulate socialization in groups.
- Enhance smell tolerance when used along with positive connotations/associations.
- Enhance smell perceptions when presented simultaneously with sound stimulations.

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