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Review Article

Sialorrhea and its Management: A Literature Review

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***ABSTRACT*:**
Sialorrhea (drooling or excessive salivation) is defined as saliva beyond the margin of the lip. This condition is normal in infants but usually stops by 15 to 18 months of age. Sialorrhea after four years of age generally is considered to be pathologic. In the present review; we have summarized some of the important aspects of sialorrhea and its management.
Key words: Sialorrhea, Treatment

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INTRODUCTION

Sialorrhea (drooling or excessive salivation) is defined as saliva beyond the margin of the lip (Hockstein et al.,2004). This condition is normal in infants but usually stops by 15 to 18 months of age. Sialorrhea after four years of age generally is considered to be pathologic. (Hockstein et al.,2004) [(1)] Neurological disorders or localized anatomical abnormalities in the oral cavity can also lead to excessive salivation.[(2)] Depending on the extent, sialorrhea may have a negative effect on the physical, functional and social well being of the patient as well as of their families and caretakers. [(1)]

Sialorrhea can be classified as anterior and posterior. Both can occur separately or simultaneously.

- Posterior sialorrhea is when the flow of saliva is from the tongue to the pharynx.
- Anterior sialorrhea is a result of incontinence of saliva or involuntary spillage of saliva over the lower lip, known as drooling

PHYSIOLOGY OF SALIVATION

The major salivary glands include parotid, submandibular, and sublingual glands; the largest being the parotid gland. The saliva secreted by the glands plays a major role in lubrication, digestion, immunity and maintaining the homeostasis of the human body [(4)]. The parasympathetic nervous system primarily controls the salivary secretion of parotid, submandibular, and sublingual glands, although sympathetic innervation has a minor influence. The contraction of the muscle fibres around the salivary ducts by sympathetic innervation of them enhances the flow of saliva[(3)] 90% of the 1.5L of saliva that is produced in a day is contributed by the major salivary glands. If salivary secretion is not stimulated, that is in basal state, 70% of total salivary secretion comes from the submandibular and sublingual glands.[(3)] Upon stimulation, salivary secretion is increased by five times, with the greater amount of saliva being delivered by parotid glands . Chewing is an example of an exogenous source causing stimulation.

The three major salivary glands produce two types of saliva mainly. Serous saliva which is thin and watery saliva is produced by the parotid gland on stimulation. While viscous saliva which is thicker is produced by sublingual and submandibular glands throughout the day. [1.4]. Both forms of these secretions can be problematic.

ETIOLOGY [2]

In children, mental retardation and Cleft Palate are the most common causes of sialorrhea. [5] In adults, Parkinson's Disease is the most common etiology. Swallowing impairment, mostly in the oropharyngeal phase, is the major contributor to the pathophysiology of sialorrhea in Parkinson Disease patients, while an increase in the speed of salivary excretion might be a minor contributor. [6]

SYSTEMIC CAUSES

- Neuromuscular/sensory dysfunction—Cerebral palsy, Parkinson's disease, Mental retardation, Motor neuron disease (ALS), Pseudobulbar/bulbar palsy, Stroke
- Medications—Antipsychotics (clozapine), Tranquilizers, Anticonvulsants, Anticholinesterases, Lithium
- Toxin exposure—Mercury vapour, Pesticides, Snake poisoning
- Infection—Rabies
- Gastric—Gastroesophageal reflux

LOCAL CAUSES

- Oral Inflammation—Teething
- Infection—Dental caries, Oral cavity infection, Tonsillitis, Peritonsillar abscess
- Anatomic—Macroglossia, Nasal blockage, Oral incompetence, Dental malocclusion, Orthodontic problems, Head and neck surgical defects

PHYSIOLOGIC CAUSES

- Pregnancy

ASSESMENT OF SIALORRHEA [7]

1. HISTORY

The history of the patient from the parent or caretaker should be taken to understand the severity and etiology of the situation and how does it affect their daily lives.

The following should be asked during history:

- Use of medications
- Language and communication skills, cognition
- Respiratory health
- Presence of gastroesophageal reflux disease
- In case of children, the number of bibs soiled should also be kept in count.

2. PHYSICAL EXAMINATION

Oral cavity should be examined for

- Sores on the lip and chin
- Dental problems
- Tongue size and movement
- Tonsillar hypertrophy
- Nasal blockage
- Malocclusion
- Jaw stability

A neurological examination for investigating the alertness level, swallowing ability, motor skills and sensory dysfunction should also be done.

3. DROOLING FREQUENCY AND SEVERITY SCALE [7,8]

Other methods of assessing salivary production and drooling

1) 1- 10 visual analogue scale (where 1 is best possible and 10 is worst possible situation)
2) Counting number of standard sized paper handkerchiefs used during the day.
3) Measure saliva collected in cups strapped to chin.
4) Inserting pieces of gauze with a known weight into oral cavity for a specific period of time and then re-measuring weight and calculating the difference between the dry and wet weights.
5) Salivary gland scintigraphy / technetium scanning.
6) Salivary duct canulation and measuring saliva production. [9]

4. OBJECTIVE METHODS TO MEASURE SIALORRHEA [11]

TECHNIQUE	DESCRIPTION
DROOLING QUOTIENT	At every 15 seconds, in a 15 minutes period the presence or absence of sialorrhea is observed.
SOCHANIWSKYJ'S TECHNIQUE	The saliva that has leaked through the mouth and reached the chin should be recorded for a 30 minute period using a glass.
OTHER TECHNIQUES	Use of collection units, towels and diapers or dental cotton rolls

DROOLING ACTIVITY	POINTS
Dry (never drolls)	1
Mild (wet lips only)	2
Moderate (wet lips and chin)	3
Severe (clothing becomes damp)	4
Profuse (clothing, hands becomes wet)	5

CAUSES OF HYPERSALIVATION IN DENTURE WEARERS

- Increased vertical dimensions: This can cause excess pressure on the soft tissue structures of edentulous ridges when a patient bites. The nerve endings to the salivary gland which are

present in the area get stimulated and lead to hypersalivation.
- Anxiety and fear of the patient towards success of denture.
- Overextension of denture borders in maxillary and mandibular dentures.
- Increased thickness of denture borders.
- Initial thought of denture as a foreign body in the oral cavity

HOW TO TREAT THEM?
- Psychological support to the patient and making them understand that hypersalivation is common in new denture wearers.
- Corrections are made to the ill fitting dentures if any needed.
- Patient can be asked to eat lozenges or chewing gum as they can help in swallowing the excess saliva being produced continuously.

MANAGEMENT OF SIALORRHEA[3]
Treatment of sialorrhea is best accomplished with a multidisciplinary team approach.
- PRIMARY CARE PHYSICIANS- The patient's complete history and physical examination can be done by them.
- SPEECH PATHOLOGISTS AND OCCUPATIONAL THERAPISTS- The education for swallowing mechanics is provided by them to the patients and they help to support their posture with devices such as the head back wheelchair.
- DENTISTS AND ORTHODONTISTS- They help to identify and correct dental and oral diseases and malocclusion.
- OTOLARYNGOLOGISTS help to diagnose and treat causes of aerodigestive obstruction like macroglossia and adenotonsillar hypertrophy that can contribute to drooling.
- NEUROLOGISTS help to assess the prognosis and severity of neurologic conditions that results in drooling.

Two main approaches are there:
1. Non-invasive approach
2. Invasive approach

NON INVASIVE MODALITIES [9]

Positioning- Proper positioning of the patient should be the first essential step before implementation of any therapy. The patient should be fully supported and comfortable when seated. Good posture with proper trunk and head control provides the basis for improving oral control of drooling and swallowing.

Eating and drinking skills- Poor eating skills can exacerbate the drooling. Special attention and developing better techniques in lip closure, tongue movement and swallowing can lead to some extent of improvement. The citrus fruits and alcohol that cause stimulation of saliva can be avoided to help control drooling.

Oral facial facilitation **-** This technique helps to improve oral motor control, sensory awareness and frequency of swallowing by the patient.
a) Icing - The effect lasts for 5-30 minutes. The tone and swallow reflex is improved.
b) Brushing- the effect lasts up to 20- 30 minutes. It is usually suggested to be undertaken before meals.
c) Vibration- improves tone in high tone muscles
d) Manipulation – like tapping, stroking, patting, firm pressure directly to muscles using fingertips known to improve oral awareness.
e) Oral motor sensory exercise - includes lip and tongue exercises.

Speech therapy- Started as early as possible to obtain good results. This helps us to improve the jaw stability and closure, increases tongue mobility and improves the lip closure. Also decreases nasal regurgitation during swallowing.

Behaviour therapy-This includes a combination of positive and negative reinforcement and overcorrection to help drooling. Suggested behaviours, like mouth wiping after swallowing are encouraged, while negative habits like open mouth and thumb sucking are discouraged. This can be done by family members and friends.

Oral prosthetic device- many prosthetic devices can also be put to use e.g. chin cup and dental appliances, to achieve mandibular stability, better lip closure, tongue position and swallowing. Cooperation and comfort of the patient is essential for better results.

Another method suggested for complete denture wearers was to incorporate a canula into the denture prosthesis to channel the saliva toward the oropharyngeal area for geriatric and handicapped patients who suffer from chronic drooling and angular cheilitis.[10]

PHARMACOLOGICAL APPROACH [2,11,12,13]
The medications can be orally (OR), transdermally (TD), and sublingually (SL)

BOTULINUM TOXIN
The botulinum toxin injection is given intraglandular which inhibits the release of acetylcholine from cholinergic nerve terminals, thereby reducing salivary secretion and sialorrhea. Since the sublingual and submandibular glands contribute most to the salivary secretions, thus the toxin is preferably injected into these glands and not parotid gland. The injection sites are

ideally assessed by ultrasound which requires the assistance of experienced medical and nursing staff. The injections must be repeated for long term effects as its effect lasts for 3-6 months.

GLYCOPYRROLATE

The oral solution of glycopyrrolate is currently the only formulation of an anticholinergic drug approved by the United States Food and Drug Administration (FDA) to treat sialorrhea in children aged 3-16 years.

SCOPOLAMINE

The salivary secretions start to increase as soon as 15 minutes and the effect is maintained for next 72 hours. It has been shown in several studies that transdermal route reduces the salivary secretions effectively by approximately 67% with its action seen just after 15 minutes. The main side effects are pupil dilation and urinary retention. Lewis et al. observed that 66% of the patients had pupil dilation, which occurs within a few days after the start of the treatment.

TRIHEXYPHENIDYL

It is one of the most commonly used drug in children for extrapyramidal syndromes. The initial mean dose being 0.095 mg/kg/day and the maximum mean dose being 0.55 mg/kg/day, two to three times a day. Side effects were seen in 69.3% of patients.

ATROPINE SULPHATE

Although atropine has been for many years acknowledged as effective, it has never been widely accepted for the treatment of chronic sialorrhea.

SURGICAL TREATMENT [8,12,13,14]

Due to the risk of permanent consequences (especially xerostomia) that can result, surgery is indicated only in severe cases, and those cases which are non-responsive to non-surgical therapies and in which sialorrhea has great impact on the health and quality of life of the children and family members/caregivers.

The first surgical treatment suggested for sialorrhea was relocation of the parotid duct which is followed by further removal of submandibular glands. Radical procedures such as bilateral division of the parotid ducts with removal of the submandibular glands and neurectomies have been proposed, but with unpredictable results. In 1974, Ekedahl suggested the rearrangement of ducts from the submandibular glands into the tonsilar fossa.[14] The function of normal passage of saliva to the oropharynx was maintained and prevented the accumulation of saliva in the anterior mouth thus ensuring the presence of saliva in the oral cavity, while keeping its contribution to the swallowing process.

CONCLUSION

The causes for hypersalivation are countless and whatever the cause be, drooling is bothersome to all, resulting in physical and psychosocial complications. Sialorrhea has a significant negative impact on quality of life for both the patient and caretaker. The management of sialorrhea continues to be a challenge in spite of various effective treatment strategies that are there to diminish saliva production. Generally, no single approach is adequately effective, and usually, a combination of therapies is used. Hence, it is essential to identify such causes, either local or systemic, in order to appropriately manage drooling. Primary mode of management includes conservative approaches, while the aggressive treatment options are reserved for more resistant patients only.

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