



## *Drooling Children*

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We are going to discuss children who have trouble with sialorrhea, also known as drooling. First we need to think about the salivary glands. As a reminder, you have four sets of salivary glands. You have the large parotid glands in the cheek, the submandibular glands, the sublingual glands, and throughout the entire oral cavity you have small, minor salivary glands.

Why do we have saliva? First of all, it lubricates or moistens the mouth. It helps buffer and clear the food, helps keep the teeth clean. It has an anti-bacterial function, and it helps with taste and digestion. In other words, you need your saliva.

It is quite common for a child or a parent to come into my consult and say, “my child makes too much saliva.” In this case, what should you do? First, you need to remember how much saliva is normal. A normal adult makes 1 to 1.5 liters of saliva in 24 hours- the same quantity as approximately four cans of soda. That is a lot of saliva! A child does not make quite that much, but there is still a lot of saliva. So the problem is not that the children make too much saliva. The problem is that they don’t swallow what they make.

The various salivary glands make different amounts of saliva. The saliva of the parotid gland is very thin (not very viscous), and in the normal unstimulated state, as in while you are reading this chapter, the parotid gland produces approximately 25% of your saliva. When you concentrate on a picture of a lemon, or even think about the lemon, you will feel your mouth begin to fill up with saliva- this is the stimulated state. It is your parotid gland which is making the majority of your “stimulated” saliva. The submandibular gland makes saliva which is a bit thicker compared to the parotid gland, and if you were just sitting and reading this chapter, it would make about 70% of your saliva, and in a stimulated state, about 25%. The sublingual glands and the minor salivary glands do not produce much of your saliva. (**Table 1**)

**Table 1.** Salivary glands characteristics

Gland	Viscosity	Unstimulated state	Stimulated state
Parotid	Watery	25%	70%
Submandibular	Semi-viscous	71%	25%
Sublingual	Viscous	3-4%	3-4%
Minor	Viscous	trace	trace

Suppose an 18-month-old comes in with continuous drooling or sialorrhea. The family reports that his shirt is always wet, he mouth is always open, he has spit on his chin, but he is an otherwise normal child (no neurologic issues). What do you do? First, you need to rule out nasal obstruction, so check to make sure that the child is able to breathe through his nose and is able to close his mouth. But usually nasal obstruction is not the problem. Usually the problem is low motor tone of the facial and oral cavity musculature. You can consider occupational therapy or speech therapy to help with the problem. But realistically, what you really need to do is reassure the parents that this will get better, that for some children this is normal, and that the child will not be drooling when he goes to university.

So when is drooling not normal? Drooling in a neurologically normal child typically stops by the age of four to five years. There is a group of children who are older, who have neurologic problems and constant drooling, and these are the children for whom we can consider doing something more. The problem with the constant drooling in these older children is that it requires a lot of care on the part of the family to clean the saliva off of these children. The saliva can cause a skin rash and in severe cases some skin breakdown. Not suprisingly, it causes some social problems, because who wants to hug a child who has saliva all over them? These days some neurologically impaired kids use computers for communication, and it is a problem for the equipment when a child is constantly dripping all over the keyboard.

How do you evaluate these children? First, you ask the family how big a problem is the drooling, is it occasional or all the time? How well does the child swallow? You look at the child, see if there are any problems with the skin, any dental problems, how can swallow, how is the nasal airway? The Thomas-Stonell & Greenberg classification system evaluates two features of the drooling: 1) the severity, ranging from dry to profuse, and 2) the frequency, ranging from never to constantly (**Table 2**)<sup>1</sup>.

**Table 2.** Thomas-Stonell & Greenberg Classification for Drooling

Severity (1-5)
<ul style="list-style-type: none"> <li>• Dry</li> <li>• Mild-wet lips</li> <li>• Moderate-wet lips &amp; chin</li> <li>• Severe-clothing damp</li> <li>• Profuse – clothing, hands &amp; objects wet</li> </ul>
Frequency (1-4)
<ul style="list-style-type: none"> <li>• Never</li> <li>• Occasionally</li> <li>• Frequently</li> <li>• Constantly</li> </ul>

When we are treating kids with drooling problems, the tricky part is to get that balance between no drooling and a moist mouth. A dry mouth is a severe complication of any treatment and can make these children miserable. It is

important that the treatments we recommend have limited or no side effects or complications. One report in the literature describes using acupuncture of the tongue to control the drooling.<sup>2</sup> The authors placed five needles in the tongue, five days a week, for six weeks, and they reported the acupuncture made the drooling better. Personally, I have never seen or tried this technique and frankly, I have a hard time imagining my patients agreeing to this therapy. Alternatively, you can consider recommending oral motor therapy for children who have mild drooling, and this therapy sometimes seems to help.

The innervation of the salivary system is complicated, but the bottom line is that it is a parasympathetic innervation, and it is mediated by acetylcholine. Many of the treatments for drooling interfere with the innervation to the salivary glands. If you cut off the innervation to salivary glands, then those salivary glands won't produce saliva.

There are several **pharmacologic agents** which can be tried. In the United States we frequently use **glycopyrrolate**, also called Robinul. It is an **anticholinergic medication** which does not pass through the blood/brain barrier. Although this medication does not cause some of the side effects of other anticholinergics, it can still cause some, the most significant being that it makes what saliva the patients have extremely viscous, and this can be very troublesome for some patients. This agent shows some side effects in up to almost 70%, and in up to 20% of users the patient will have to discontinue the medicine.<sup>3</sup> Even so, in our country this is what people usually try first. It also has to be given three times a day, which can be a burden for the family.

You can also use a **scopolamine patch**. These are small patches you put on the skin, behind the ear. They have many potential side effects, but the patch is quite easy to use.

Alternatively, you can consider **injecting botulinum A toxin** directly into the salivary glands. You have probably heard about injections of botulinum toxin in people who want to make their wrinkles go away, but it can also be used to decrease salivary flow. The botulinum toxin works by blocking the release of acetylcholine, thereby interrupting the innervation of the gland and blocking the release of saliva. The botulinum toxin may be injected into either the submandibular glands and/or the parotid glands. Because the submandibular glands make 70% of the saliva in the unstimulated state, if you are going to decrease the flow of saliva, you need to treat the submandibular glands. An ultrasound can be used to find the glands, or you may palpate them on physical examination. The procedure can be performed using local, topical, or general anesthesia.

In the Netherlands, a prospective clinical trial compared the use of **scopolamine patch and Botulinum toxin injection**.<sup>4</sup> The trial included 45 children with cerebral palsy and neurologic difficulties. They used the scopolamine patch first, and then the children received Botox injections, and the results were compared. In this trial when the scopolamine patch was placed on the children, the drooling improved, and when the patch was removed the drooling worsened. The children then underwent Botulinum toxin injection which also lessened the drooling but for a longer period of time. Unfortunately, 70% of the children had moderate to severe

side effects from the scopolamine patch. The principal advantage of the Botulinum toxin injections is that the effect is local, and the child does not have side effects in other organ systems. The disadvantage is that it requires an injection.

Now what about **surgical treatments**? Briefly, again, the key is to get a moist mouth with no drooling. You occasionally see a child with mild drooling who has his mouth constantly hanging open. The child has **large tonsils and adenoids**, and you can improve the situation by **removing the tonsils and adenoids**. But this is usually not the case. **Usually children with large tonsils and adenoids do not have significant drooling problems**. If a child has significant drooling, taking out the tonsils and adenoids usually will not result in much improvement.

Some people say the easiest surgical treatment is **to tie off the submandibular ducts, or the submandibular and parotid ducts**, and this is a reasonable thing to do. It is not too technically difficult, but there is a recent review that is somewhat concerning about this procedure.<sup>5</sup> In this study, the authors followed 31 drooling patients, and they tied off various combinations of ducts, but they found a recurrence of the drooling in 68% of patients at a mean post-operative check of four months. Another option is to simply **remove the submandibular glands and tie off the parotid ducts**.<sup>6</sup> This works very well. Of 93 patients who underwent this procedure from 1988-1997, 87% reported no further drooling or significant improvement. The downside of this approach, with surgery on both the submandibular and parotid glands, is that 10% had a very dry mouth after surgery, which is a significant complication. Also, another 14% had no improvement in the drooling. With any of these surgical techniques, the family must always be warned that there is a chance that the surgery will not help.

**Submandibular duct relocation** has been described. The goal of this surgery is to move the submandibular duct from the front of the mouth to the back of the mouth thereby lessening the amount of saliva which falls out of the mouth. There is one study that looked at just performing the submandibular duct relocation.<sup>7</sup> They found marked improvement in 51%, moderate improvement in 29%, no improvement in 20%. The downside of not taking out the sublingual glands is that a significant percentage (9%) had a postoperative ranula.

There is a more recent study that looked at submandibular duct relocation combined with the excision of the sublingual glands.<sup>8</sup> This study evaluated the results in 72 patients and they found significant improvement in both the drooling severity and frequency scores. Fewer children needed to use bibs. They had some complications, most of them resolved.

In conclusion: for the child with chronic sialorrhea who is age five or older there are several medical options such as **botulinum A toxin injections, glycopyrolate, and the scopolamine patch**; and there are **several surgical options such as bilateral submandibular duct relocation**. The good news is that there are things we can do for these children. The bad news is that **they do not always work**.

## References

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