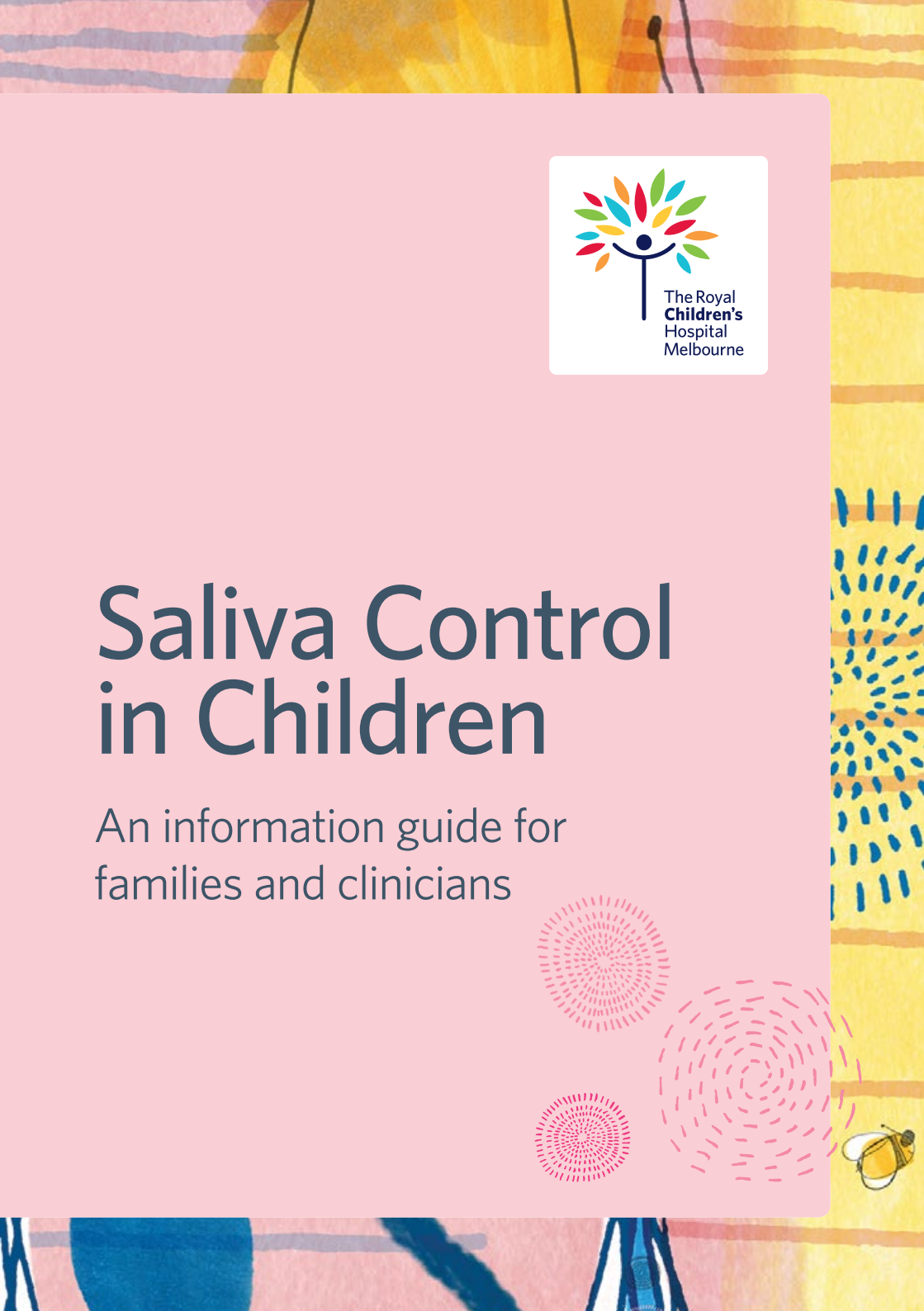

The Royal Children's Hospital Melbourne

Saliva Control in Children

An information guide for families and clinicians

This book was written by staff from:

Neurodevelopment and Disability
www.rch.org.au/neurodevelopment-and-disability

Dentistry
www.rch.org.au/dentistry

Plastic and Maxillofacial Surgery
www.rch.org.au/plastic

Speech Pathology
www.rch.org.au/speech

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Introduction

Drooling (also known as poor saliva control, 'sialorrhoea' or 'dribbling') is sometimes a problem in children and adolescents with cerebral palsy, intellectual disability and other neurological impairments. The incidence of drooling has been found to be as high as 40% in young people with cerebral palsy.

In addition to the social implications for children and families, excessive drooling can cause skin irritation and require frequent changes of clothes and bibs.

We have written this booklet to answer some of your questions and to provide information about assessment and management of drooling.

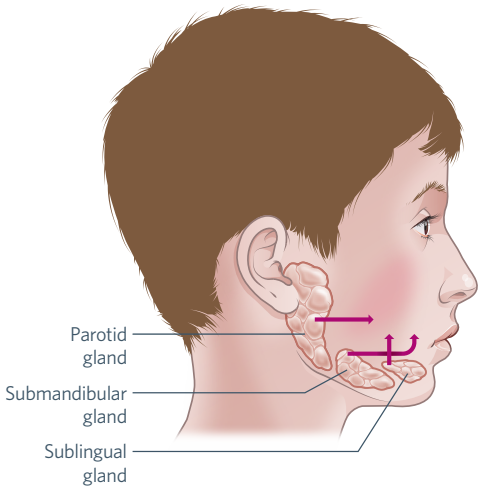
How is saliva produced?

There are three major pairs of glands in the mouth, the submandibular, sublingual and parotid glands. It is estimated that 500 to 2000 ml of saliva is produced per day.

The submandibular and sublingual glands produce saliva through ducts in the front of the mouth just under the tongue *(see Figure 1)*. The submandibular glands produce most (about 65%) of the saliva in the mouth and their secretions are watery. The sublingual glands produce a little saliva that is thick and mucousy. The parotid glands produce saliva through ducts which open into the mouth near the second upper molar teeth. These large glands are most active during meal times.

The autonomic nervous system involving both parasympathetic and sympathetic nervous systems is responsible for the overall control of salivation. These nerves are not under conscious control.

Figure 1. Location of the major salivary glands with ducts shown as arrows



Blowing bubbles. This may help to develop oral awareness (see page 9)

What are the major functions of saliva?

- Lubricates food to assist with chewing and turns food into a bolus (soft ball) for ease of swallowing
- Lubricates the tongue and lips during speech
- Cleanses the teeth and gums and assists with oral hygiene
- Regulates acidity in the oesophagus (gullet)
- Destroys micro-organisms and clears toxic substances
- Facilitates taste
- Initiates carbohydrate digestion

Why do some children drool?

Drooling can be a normal occurrence in the first six to eighteen months of life until oral-motor function is developed. It is considered abnormal for a child older than four years to exhibit persistent drooling and this problem is most commonly seen in cerebral palsy or other conditions with severe neurological impairment. There is a small group of able-bodied children who drool up to about the age of six years.

Drooling is not normally a result of overproduction but inefficient control of salivary secretions. This may be due to:

- lack of awareness of external salivary loss
- Inadequate lip closure resulting in an open mouth posture
- Absent or impaired oropharyngeal (mouth and back of throat) sensation
- Abnormal movements/abnormal tone of the tongue and lips (sometimes known as intra-oral motor impairment)
- Reduced frequency of swallowing and difficulty with swallowing (sometimes known as dysphagia)
- A combination of these factors.

Good-quality scarves/cravats may help absorption of secretions

There may be other contributory factors:

- Poor posture (impaired head and/or trunk control)
- Dental problems such as dental caries and malocclusion
- Mouthing of objects
- Medication being used for other purposes, for example, clonazepam (Rivotril) for epilepsy.

How is drooling assessed?

A multidisciplinary approach is helpful. An attempt is made to determine which of the factors listed above may be contributory. For example, does the child have an open mouth posture, or abnormal movements of the tongue and lips?

Questions are asked about:

1. **General health** – drooling often becomes more profuse and problematic when children have recurrent upper respiratory infections or nasal obstruction
2. **Medications** – knowing about drugs being taken can help to determine if they are contributing to the problem
3. **Dental history** – poor dental care and cavities are often associated with drooling
4. **Eating and drinking** – as poor saliva control is frequently accompanied by problems with chewing and difficulties with swallowing
5. **Communication abilities** – some children do not have oral speech because of severe oral motor difficulties. These children often have eating and drinking problems and also drool.

MEASURING DROOLING SEVERITY AND FREQUENCY

The severity and frequency of drooling is often measured using the five-point drooling severity score and the four point drooling frequency score *(see Figure 2)*.

Figure 2. Thomas-Stonell and Greenberg scale

Drooling severity	
1	Dry
2	Mild – wet lips
3	Moderate – wet lips and chin
4	Severe – clothing damp
5	Profuse – clothing, hands and objects wet

Drooling frequency	
1	Never
2	Occasionally
3	Frequently
4	Constantly

SALIVA MANAGEMENT CLINICS

Specialised clinics for saliva management exist in some centres. The Saliva Control Clinic at The Royal Children's Hospital, Melbourne is a multi-disciplinary clinic with a speech pathologist, a paediatric dentist, paediatrician, plastic surgeon and nurse coordinator.

Information is gathered by having the family complete a questionnaire prior to their appointment. At the clinic, a history of the saliva control problem is taken, the children are observed and an assessment of drooling is made by carers and clinicians using the drooling frequency and severity scores described on page 6. Recommendations are made at the conclusion of the clinic visit that may include further management by a local speech pathologist, referral for dental treatment, consultation with an ear, nose and throat specialist, or as detailed on the following pages, conservative measures, the use of medication, a trial of an oral appliance or a recommendation for surgery.

Oral screen

How is drooling managed?

There are five approaches:

1. **Conservative management**
2. **Oral appliances**
3. **Medication including oral medications, oral drops and dermal patches**
4. **Botulinum toxin injections**
5. **Surgical management**

Girl inserting oral screen, with the aim of encouraging lip seal

Conservative management

- Management of underlying problems
- Helping children be more aware of saliva and oral movements
- Eliminating mouthing behaviours
- Encouraging children to swallow more, and wipe their face
- Improving and maintaining oral health

MANAGEMENT OF UNDERLYING PROBLEMS

It may be possible to address underlying problems that may be aggravating drooling, for example, the presence of nasal obstruction, dental disease or the use of medication that may be contributing to the problem. Physiotherapy or occupational therapy may be helpful in improving posture and seating, for example, wheelchair modifications may facilitate better head control. Repositioning the computer screen and input device (keyboard or switch) may also be helpful in achieving improved posture.

HELPING CHILDREN BE MORE AWARE OF SALIVA AND ORAL MOVEMENTS

When we get enough saliva in our mouths we swallow it automatically and thus we do not drool. This does not seem to happen in children who drool. Some children seem very unaware of what is in and around their mouths and can also be messy eaters, getting food around their lips, cheeks and chin. Many children seem not to notice the saliva escaping the mouth until it is too late to retrieve it.

Developing eating skills

Developing eating skills specifically related to saliva control can be helpful. This includes developing lip control by increasing the length of time that children can maintain lip closure and developing lateral tongue movements in chewing. This is encouraged by the placement of different food textures, graded from easy to chew to more difficult to chew, between the molars. Building up the child's awareness of saliva both inside and outside of the mouth is very helpful.

Behavioural approaches and techniques to help the child be more aware of saliva and oral movements can reinforce each other. The behavioural approach involves teaching the child to recognise the feeling of wetness and be able to either swallow more frequently or wipe the saliva from the lips and chin.

Speech pathologist teaching exercises to develop lip closure

Exercises and games

Many children have lips that are incapable of making a firm seal. Some children have a retracted and short upper lip or have protruding teeth so that their lips are unable to meet. Inability to bring the lips together makes it more difficult to swallow properly and this may result in drooling.

A series of exercises can be tried that may help to develop lip closure and saliva suction. It is important to make these exercises fun.

- Use of facial expressions, for example smiling, frowning, pulling faces in the mirror.
- Lip articulations – *mmmm*, *bbbb*, *pppp*, raspberries.
- Playing kissing games – put lipstick on the lips and leave a kiss on a mirror, tissue or hand.
- Blowing musical instruments e.g. harmonica, party whistle.
- Holding paper or a spatula between the lips for increasing lengths of time.
- Practicing maintaining lip seal around an oral screen (see page 18) placed in front of the teeth as a 'mouth guard'.
- Sucking liquid up straws of various thickness, starting with a short straw. Clear plastic tubing may be easier to use rather than straws. The liquid may be thickened to make the task more difficult, for example, giving the child a thick shake.

- Holding a bent full straw of liquid (with your finger over the top), releasing the liquid either into the buccal cavity (inside the cheeks) or else directly onto the tongue, and encouraging the child to suck up the liquid.
- Blowing games such as blowing out candles (starting with one candle and working up), puffing bits of tissue or table tennis balls across the table. Children can be encouraged to blow out their cheeks and push the air from one side to another. Use of a mirror may help them understand what is required.
- Playing games that require sucking air up a straw with the objective of picking up a pea or small pieces of paper, ensuring that the peas are larger than the straw! Counting how many peas can be placed into a container in three minutes can be a fun activity.

Devices

Battery operated vibrators can be used to stimulate the muscles in the cheeks and around the lips. Vibrators come in all sorts of shapes but you should use a small one (or one with a small head). The back of the head of a battery operated toothbrush can also be used.

Speech pathologist showing oral exercises

People that can help

Input from speech pathologists and co-operation from the child and other key people in children's lives such as their parents and teachers, are required for these strategies to be successful.

Speech pathologists can advise which strategies are most appropriate. To achieve any substantial change, long term intervention is required which also includes considerable commitment by children and their families.

The success of these techniques depends on factors such as oral motor abilities and the capacity to follow directions. For example, in severe cerebral palsy the problems with control of the tongue and lips may be so severe that it is difficult for some children to achieve any change, despite their best efforts.

ELIMINATING MOUTHING BEHAVIOURS

Some children love to suck their fingers and when their hands are in their mouth, drooling becomes worse.

Children often suck their hands for comfort and because they like the sensation. It is best to give children something else to do, for example:

- Providing an activity that requires the use of the hands, for example, a puzzle or toy, a mobile, or playing in water.
- Providing an activity for the hands that gives a very positive sensory feel, for example, a vibrating toy/cushion, a box of scarves or finger painting.
- Engaging children in some other way, for example, reading a book with them, singing or playing hand games.

Some children will respond to either verbal or visual prompts to take their hands out of their mouths.

A suitable distractor to discourage mouthing behaviours

For those children who suck their hands habitually to such an extent that their skin gets broken and sore, ask an occupational therapist for some advice.

The following can be tried:

- Sometimes the use of brushing to provide deep sensory stimulation to the muscles and nerves can be very satisfying for children and encourages them to use their hands differently.
- Wearing gloves with a range of objects of different textures attached, for example, bells or pot scourers, so children play with these objects rather than with their fingers. The objects must be firmly attached to the gloves.
- Putting different tasting or unpleasant substances on the fingers.
- Using elbow splints to stop children putting their hands into their mouths. These splints are designed so that the hands can still be used.

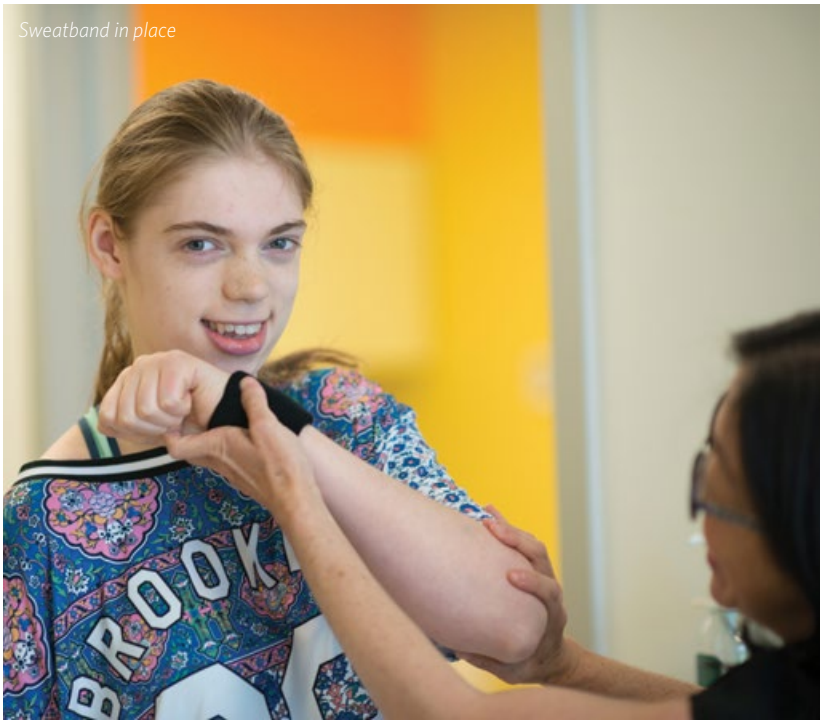
A multidisciplinary team is involved in the care of your child

ENCOURAGING CHILDREN TO SWALLOW MORE, AND WIPE THEIR FACE

Many children who drool have difficulty in knowing if their lips and chin are wet and because of this, they do not think to wipe. It is helpful to provide reminders for them, such as a cue or a reward. It is also useful to teach 'swallow and wipe' together because the mouth is cleared of saliva with each wipe. Verbal reminders need to be very frequent.

The following suggestions may also be useful:

- Providing a small mirror and showing children when the face or chin is wet.
- Using touch cues; sometimes pressing a finger on children's top lip helps them to swallow.
- Using visual cues such as coloured dots. When children see them, they are encouraged to swallow and wipe. Signs such as parents touching their own lips with their fingers can be a cue.
- Using auditory cues such as setting a kitchen timer and encouraging a swallow/wipe after the buzzer. 'Acualarms' are buzzers that fit into an earplug. There are also apps such as 'Swallow Prompt' which provide an auditory cue. Speech pathologists can provide further information.
- Reading a book and asking children to swallow and wipe at the end of every page.



Sweatband in place

Praise is a good reward. Food is not a good reward because it makes children produce more saliva. However food rewards can be used for a period of time, for example, if children can stay dry whilst watching television, then a food reward could be offered such as a chocolate milkshake. Items such as stickers or collectables are preferable, or anything that is affordable and desirable to the child. Always make sure there are plenty of opportunities for success.

Make sure to check children's chins. When dry, praise or rewards can be given. Provide handkerchiefs, remembering that many children find it difficult to remove them from their pockets. They can have a handkerchief tied to their wrist for easy access or alternately, a sweat band on the wrist can be used to wipe the chin. People in wheelchairs can have a foam ball on a goose neck stand fitted. A handkerchief is placed over the ball and changed as required.

IMPROVING AND MAINTAINING ORAL HEALTH

Oral health

Saliva protects the teeth from attack by neutralising the acids that are produced after eating and drinking. Saliva normally provides a protective barrier against sensitivity, erosion and decay. Adverse changes to the quantity and quality of saliva may occur following management of drooling either by medication or surgery. As a result, the teeth are more susceptible to plaque retention and associated dental disease such as decay or gingivitis (gum inflammation). Therefore, the maintenance of optimal oral health is essential.

Oral care at home

Good oral hygiene can be maintained by brushing thoroughly twice a day with a soft-bristled manual or electric toothbrush and using fluoridated toothpaste. Children with good manual dexterity should be encouraged to brush their own teeth. Parents and carers need to assist with thorough brushing at least once a day particularly when oral-motor dysfunction is present. Replace the toothbrush every three months or sooner if the bristles begin to look worn out. Clean between teeth regularly using dental floss, 'flossettes' or 'piksters' to remove plaque from areas that the toothbrush cannot reach.

The dental examination — an important aspect of care

Professional advice and care

Regular dental visits every 4–6 months are important for detection of early signs of dental disease and for appropriate preventive strategies to be implemented. If an individual is prone to plaque build-up, bad breath (halitosis), and/or subsequent gum problems, the dentist may recommend the following:

- A professional scale and clean to remove plaque and tartar every 3–6 months.
- Use of a mouth rinse following regular tooth brushing and flossing.
- Placement of dental sealants that fill the pits and fissures with a plastic resin material that prevents plaque from being trapped, thereby preventing dental decay.

When dental decay has occurred, the dentist may recommend some products in addition to toothpaste to provide more protection against tooth decay:

- Topical fluoride – this may be applied in the form of a gel, tablets or rinse. Fluoride makes teeth more resistant to the acids produced after eating or drinking. Fluoride also puts back minerals that are lost from teeth and can reverse the early signs of tooth decay.
- Tooth Mousse® – this product contains calcium and phosphate, the major minerals found in teeth. Because these minerals are carried in a special milk derived protein called Recaldent they are available in a soluble form. Tooth Mousse® can protect the teeth like saliva and replace minerals lost by regular acid attack after eating and drinking. It is usually used twice daily after brushing and should be left in contact with the teeth for at least three minutes.

'Tooth friendly' tips

- Encourage healthy snacks such as dairy products (e.g. milk, cheese and yogurt), plain popcorn, fruit and vegetables in place of place of sugary snacks.
- Avoid foods such as honey, dried fruits, chocolates and sweets, biscuits, jams, cakes, sugary breakfast cereals, muesli bars and fruit roll-ups.
- Keep healthy snacks readily available for children to eat.
- Limit intake of acidic and sweet drinks such as fizzy colas, sports drinks, fruit juices, fruit drinks, cordials.
- Drink lots of water. Note that not all bottled water has fluoride to help prevent tooth decay.

Speech pathologist inserting oral screen

Oral appliances

Some children may benefit from wearing an oral appliance to help oral awareness and oral motor control. This approach needs close cooperation between a dentist and a speech pathologist as each appliance is individually made.

An appliance is usually part of a conservative approach to treatment and additional exercises may be necessary. There are a number of appliances that may help the child to better position the tongue in the mouth and swallow more effectively.

Appliances can be challenging for children and families and require careful prescription and supervision. Intra oral prostheses such as the oral screen are sometimes used. An appliance called the ISMAR (Innsbruck Sensory Motor Activator and Regulator) is designed to provide stability for the jaw in order to develop lip and tongue ability and must be supervised by a dentist with special expertise in this area. It is only useful in a small proportion of young people with drooling.

Research conducted at The Royal Children's Hospital indicates that this could be an effective treatment for children with cerebral palsy who are motivated and able to follow instructions. The device is worn for short periods of time every day and it may take over a year for improvement to occur.

Another type of oral device is the oral screen. This is worn only for short periods of time to encourage children to keep their lips together. It fits between the teeth and the lips and children are asked to keep their lips firmly sealed around it. This exercise is done at home or in the context of a therapy session.

Medications

Oral medication

Anticholinergics particularly Benzhexol hydrochloride ('Artane'), Benztropine and Glycopyrrolate ('Robinul'), are successful in drying the secretions in some children. These drugs work by blocking the transmission of autonomic (parasympathetic) nervous system signals to the salivary glands. They may also have impact on other parts of the body, particularly the sweat glands. Side effects, particularly sedation and restlessness, may limit their use. These medications should be introduced gradually at slowly increasing dosages, as the effective dose for an individual varies considerably.

In general, medication appears to be most useful in:

1. Young children where maturation of oral function may still occur.
2. In older children and adults with relatively milder saliva control problems.
3. As an alternative to surgery for those who prefer a non-surgical approach.

Medication may be provided as tablets (benzhexol hydrochloride, benztropin and glycopyrrolate), oral suspensions (glycopyrrolate), oral drops (Atropine – usually used for ophthalmic purposes) and dermal patches (hyoscine 'Scopolamine').

In general tablets or oral suspensions are preferred. More details of the commonly prescribed medication, that is, benzhexol hydrochloride and glycopyrrolate are provided below.

It is difficult to control the dosage of oral drops and patches have not been shown to be more effective than glycopyrrolate, hence no further information is provided about them.

Benzhexol hydrochloride

The dosage required for any individual is quite variable. A low dose is used initially, and if this is not effective, the dose is increased. The medication begins to act within an hour, peaks at 1–3 hours, and the duration of action is 6 –12 hours. It is therefore best to take the medication at breakfast, and then either at lunchtime or after school so that drooling is controlled during most of the waking hours. The tablets should be taken with meals. If they cannot be swallowed, they can be crushed and placed in food. Other management programs, for example, encouraging the child to wipe, should still be continued.

Worthwhile effects can be obtained in many patients. If there are no beneficial effects at all, the tablets should be discontinued after a six-week trial.

Side effects are uncommon, but it is important to be aware of them. They include a change in behaviour such as irritability or confusion, blurred vision, constipation, difficulty passing urine and flushed dry skin, the latter due to the impact of benzhexol hydrochloride on the sweat glands. As with any drug, other side effects are possible but unlikely.

If there are concerns about possible side effects, it is best to stop the tablets and consult your doctor. In addition, it is advisable to withhold the medication on very hot days because of possible impairment of sweating.

The recommended dosage regime is as follows:

- Benzhexol hydrochloride 1 mg (half a tablet), twice daily for one to two weeks (at breakfast and then at lunch time or after school).
- If there is no improvement, the dose is increased to 2 mg (one tablet), twice daily for a further one to two weeks.
- The dose may be further increased to 2 mg (one tablet), three times daily (at breakfast, lunch and evening meal).
- Some children can tolerate higher doses but it is important that this is done under careful medical supervision.

Glycopyrrolate

The dosage required is quite variable. A low dose is used initially, and if this is not effective, the dose is increased. The duration of action of the medication is 8–12 hours.

It is best to take the medication at breakfast, and then either at lunchtime or after school. Glycopyrrolate is usually available as a liquid but can be obtained in tablet form in Australia with approval from the appropriate Government authority. If tablets are used, they should be taken with meals. If they cannot be swallowed, they can be crushed and placed in food. Good effects are reported in a substantial proportion of individuals. If there are no beneficial effects, the tablets should be discontinued after the six week trial.

Side effects are said to be less frequent than with Artane (Benzhexol Hydrochloride). A change in behaviour or confusion, blurred vision, constipation, difficulty passing urine and flushed dry skin are possible.

The starting dose is .01 mg (or 10 μg) per kg per dose. The medication is taken twice daily, and is best given at breakfast and at lunchtime or after school. There is 1 mg of glycopyrrolate in each tablet. The dose may be further increased to a maximum of 0.04 mg (or 40 μg) per kg per dose three times daily (at breakfast, lunch and evening meal).

Botulinum toxin injections

Botulinum toxin A (or 'Botox') has been used in the management of spasticity (tightness of muscles) in conditions such as cerebral palsy. The drug works by blocking the transmission of nerve impulses to muscles, sweat glands and salivary glands.

For drooling, the drug is injected directly into the saliva glands, under the guidance of ultrasound. The procedure is done under a brief general anaesthetic as a 'day stay' procedure. Four injections of approximately 1 ml are usually given, one into each of the submandibular and parotid glands.

Drooling is usually reduced for about six months but can be for shorter or longer periods in some children. Sometimes botulinum toxin is not effective at all.

The side effects may include minor bruising and swelling in the area of the injections as well as the possible side effects associated with a brief anaesthetic. Occasionally speech and swallowing can be affected, possibly due to the drug spreading beyond the injected glands and weakening the muscles of the throat.

Surgical management

A surgical approach is taken if:

1. Drooling is so severe that conservative measures are unlikely to achieve a satisfactory outcome.
2. Compliance with conservative measures is unlikely due to severe intellectual and/or physical disability.
3. The child is older than six years and conservative treatment is failing. Maturation of oral motor function can continue up until the age of six in children with developmental disabilities so surgery is not usually offered prior to this age. The range of surgical options include denervation of the salivary glands, removal of salivary glands, ligation of salivary ducts and relocation of ducts.

The preferred surgery at The Royal Children's Hospital is removal of the sublingual glands and relocating the submandibular ducts to a position at the back of the tongue.

The aim is for the redirected saliva to be swallowed instead of escaping from the mouth. There is significant improvement in 80% of children and adolescents undergoing the procedure.

The operation lasts for approximately 60–90 minutes and requires a general anaesthetic. A temporary stitch is sometimes placed in the tongue in order to keep the airway clear and this is left in place for up to 24 hours. There is swelling in the mouth for a few days and intravenous fluids are given to maintain hydration during the first 24 hours. It is a significantly invasive surgery.

Possible early complications, which may occur with any operation, include bleeding, swelling or infection. One rarely reported complication is severe or prolonged swelling of the tongue requiring admission to the Intensive Care Unit. Possible late complications are swelling in the glands in the floor of the mouth which may need another operation.

The hospital stay is usually three to four days. Patients should eat soft food for 1–2 weeks after the operation. Following surgery, children are reviewed by the multi-disciplinary team and drooling assessments are completed at one month, six months, one year, two years and five years postoperatively.

Good oral care with regular dental checks (every six months) is very important after the surgery. Saliva is protective for teeth and moving it to the back of the mouth puts the front teeth in danger of developing decay. Your dentist should be informed about this operation.

What to do when drooling cannot be controlled

Saliva causes staining of clothes and can smell and be offensive if the drooling is severe. When children are young, waterproof backed bibs can be changed frequently.

As children grow older, there needs to be more appropriate ways of disguising the dribbling:

- Scarves may be worn around the neck to absorb the excess saliva. These may be backed with absorbent fabric such as towelling. Matching scarves worn with different outfits can be a sophisticated way of disguising the drooling. It is a good idea to have several of the one colour as they will need to be changed regularly.
- Towelling panels can be sewn into windcheaters to absorb excess saliva. Waterproof material can be sewn in to line garments to keep the wet fabric away from the skin.
- Vests that are easily changed can be designed to go over dresses.
- Velcro can be sewn onto clothes and motifs/collars attached. When the motif gets wet, it can be quickly replaced with another one.
- Windcheaters that have a raised motif on the front can give the appearance of a windcheater which is drier for longer.
- Plain materials show the dribbling more. Choose patterned materials.
- Towelling sweatbands can be used as cuffs for wiping saliva.

Brightly coloured scarves and cravats can be attractive

In conclusion

There are many ways in which drooling can be controlled. More conservative approaches are always tried first. It may take time and trials of different treatments before the best management plan is found for each individual child.

Your speech pathologist, dentist and/or paediatrician may be able to answer your questions and provide you with good advice. They may refer your child to the Saliva Control Clinic at The Royal Children's Hospital if you live in Victoria, or to a similar clinic if you live elsewhere. A referral is needed for an appointment at the Saliva Control Clinic. Please ask your GP, paediatrician, speech pathologist, or other health professional to fax a referral to The Royal Children's Hospital on 9345 5034.

Research is being undertaken to improve our ways of managing saliva control problems in children. Our aim is always to have the best care and quality of life for every child.

Further information

This booklet is also available online, and a PDF can be downloaded for printing. See https://www.rch.org.au/neurodevelopment-and-disability/saliva/

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Neurodevelopment and Disability
The Royal Children's Hospital Melbourne
50 Flemington Road Parkville
Victoria 3052 Australia
www.rch.org.au/neurodevelopment-and-disability