



Hypersalivation: update of the German S2k guideline (AWMF) in short form

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Abstract

Hypersalivation describes a relatively excessive salivary flow, which wets the patient himself and his surroundings. It may result because of insufficient oro-motor function, dysphagia, decreased central control and coordination. This update presents recent changes and innovation in the treatment of hypersalivation. Multidisciplinary diagnostic and treatment evaluation is recommended already at early stage and focus on dysphagia, saliva aspiration, and oro-motor deficiencies. Clinical screening tools and diagnostics such as fiberoptic endoscopic evaluation of swallowing generate important data on therapy selection and control. Many cases profit from swallowing therapy programmes to activate compensation mechanisms as long compliances are given. In children with hypotonic oral muscles, oral stimulation plates can induce a relevant symptom release because of the improved lip closure. The pharmacologic treatment improved for pediatric cases as glycopyrrolate fluid solution (Sialanar[®]) is now indicated for hypersalivation within the EU. The injection of botulinum toxin into the salivary glands has shown safe and effective results with long-lasting saliva reduction. Here, a phase III trial is completed for incobotulinum toxin A and, in the US, is indicated for the treatment of adult patients with chronic hypersalivation. Surgical treatment should be reserved for isolated cases. External radiation is judged as a safe and effective therapy when using modern 3D techniques to minimize tissue damage. Therapy effects and symptom severity have to be followed, especially in cases with underlying neurodegenerative disease.

Keywords Hypersalivation · Drooling · Dysphagia · Glycopyrrolate · Oro-motor and oro-sensory therapy · Botulinum toxin · Sialorrhoea

Introduction

Hypersalivation (sialorrhoea) usually refers to a relatively excessive flow of saliva, which can lead to many issues from wetting of the lips, chin, hands, environment to saliva entering the deep respiratory tract due to insufficient orofacial muscular control and/or a disturbance of sensomotoric control of the swallowing process. Drooling, on the other hand, describes a consequence of hypersalivation, namely the outward flow of saliva from the mouth. This symptom often accompanies a variety of neurological diseases (Lagalla

et al. 2009; Stone and O'Leary 2009; Steffen et al. 2013; Prosiegel and Buchholz 2014; Squires et al. 2014; Checklin et al. 2015). In children, cerebral palsy and a number of congenital syndromes are associated with a sometimes considerably increased flow of saliva. Hypersalivation can also be found in the case of defect disorders in the head and neck area following trauma or tumor or as a side effect of neuroleptics.

Since the first compilation of this guideline in 2013, the state of knowledge in almost all sub-areas of this symptom has expanded and, therefore, made it necessary to update it (Steffen et al. 2013). In almost all diagnostic and therapeutic areas, new publications have resulted in improved evidence and, for the first time, in pharmacological on-label therapies explicitly for patients with hypersalivation.

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Aim of this guideline

The aim of this S2k guideline is to promote high-quality specialist and therapeutic care for patients with hypersalivation. The aim is to provide meaningful diagnostics and therapy based on the current state of knowledge.

On behalf of the Deutsche Gesellschaft für Hals-Nasen-Ohren-Heilkunde, Kopf- und Hals-Chirurgie e. V., their working group on salivary and thyroid gland diseases has developed this guideline in close cooperation with the Deutsche Gesellschaft für Phoniatrie und Pädaudiologie e. V. (German Society for Phoniatics and Pedaudiology), the Deutsche Gesellschaft für Sprach- und Stimmheilkunde e. V. (German Society for Speech and Voice Medicine), the Deutsche Gesellschaft für Psychiatrie und Psychotherapie, Psychosomatik und Nervenheilkunde e. V. (German Society for Psychiatry and Psychotherapy, Psychosomatics and Neurology), the Deutsche Gesellschaft für Neurologie e. V. (German Society for Neurology), the Deutsche Gesellschaft für Neurorehabilitation e. V. (German Society for Neurorehabilitation), the Deutsche Parkinson-Gesellschaft e. V. (German Society for Parkinsons Disease), the Deutsche Parkinson-Vereinigung e. V. (German Union for Parkinson Disease), the Gesellschaft für Neuropädiatrie (Society for Neuropaediatrics), the Deutsche Gesellschaft für Radioonkologie e. V. German Society for Radiooncology and the Deutsche Gesellschaft für Mund-, Kiefer- und Gesichtschirurgie e. V. (German Society for Oral and Maxillofacial Surgery).

This guideline has been prepared in accordance with the methodological guidelines for the development of guidelines for diagnostics and therapy of the Association of Scientific Medical Societies (AWMF) and corresponds to an S2k (consensus-based) guideline according to the three-step concept of the AWMF. The guideline was first updated in several rounds by the guideline coordinator after consultation and informal consensus finding of the parties involved in the guideline preparation. Then, for further consensus finding in a structured DELPHI process, it was agreed between the mandate holders of the participating medical societies.

The present guideline was submitted for comment to the department of guidelines of the Deutschen Berufsverbandes der Hals-Nasen-Ohrenärzte e. V. (German Professional Association of Ear, Nose and Throat Doctors), the Deutschen Bundesverband für Logopädie e. V. (German Federal Association for Speech Therapy), the Deutschen interdisziplinären Gesellschaft für Dysphagie e.V. (German Interdisciplinary Society for Dysphagia), the Arbeitskreis Botulinumtoxin (Botulinum Toxin Working Group) and the Bundesverband Deutscher Nervenärzte e.V. (Federal Association of German Neurologists).

Etiology and pathophysiology

Normal saliva control requires effective lip and jaw control as well as an intact swallowing function. The rapid succession of the oral, pharyngeal and esophageal phases of the swallowing act must be coordinated with respiration, since swallowing a bolus always requires closure of the airways. Up to the age of 18 months, hypersalivation as the leakage of saliva from the mouth is to be regarded as a maturation process within the framework of physiological orofacial motor maturation; a persistence of this symptom in the waking state from the age of 4 is to be regarded as pathological (Blasco and Allaire 1992; van Hulst et al. 2018).

To avoid hypersalivation, fine tuning of neuronal and muscular processes is important, especially in the oral cavity and pharynx. Their disturbance occurs with neuronal disintegration in cases of neurological deficits such as cerebral palsy, after brain trauma or brain infarction as well as in the context of neurodegenerative diseases. Another cause is the lack of integrity of the mouth and jaw region due to malformations or traumatic defects. In the various stages of treatment of patients with head and neck malignancies (S3 Leitlinie Palliativmedizin 2015), massive swallowing disorders with reduced salivary clearance may occur, leading to hypersalivation. As a true hypersalivation due to increased saliva production, the phenomenon is to be regarded as a drug side effect, as it occurs in treatment with atypical antipsychotics, e.g., clozapine (Verma and Anand 2017). In addition, dopamine antagonists can lead to hypersalivation by provoking a Parkinson's-like disease with reduced swallowing frequency.

Diagnostic procedures

For the clinical evaluation of the severity of typical symptoms, the rating by the patients is crucial, but in most cases the assessment of relatives and caregivers must also be included. Relevant influencing factors are activity level, body position, mood and orofacial motor skills. Special attention is required when assessing the intellectual abilities of children with hypersalivation, as these are often underestimated by the visual impression. Standardized questionnaires such as the Teacher Drooling Scale, DSFS (Camp-Bruno et al. 1989) and the Drooling Severity and Frequency Scale (Crysdale and White 1989) proposed by the working group around Crysdale and White (1989), and Thomas-Stonell and Greenberg (1988), are also suitable for monitoring the course of therapy. These scales measure the hypersalivation intensity and frequency, for example, to better document the course of therapy. Quantitative measurements of saliva are methodologically not very reliable and have not

yet found their way into clinical practice. Available methods are so-called chin cups, the recording of soaked bibs or shirts (Blasco 2002) or the weight of cotton rolls (Ellies et al. 2002a, b).

In addition to the cranial nerve status, muscle tone, head posture and probable anatomical causes of mouth breathing must also be considered in the physical examination. When assessing the oral cavity, the size and structure of the palatine tonsils, a possible pathological interdental resting position of the tongue or tongue thrusting and possible malocclusions are important. Even minor tooth malpositions or occlusion disorders—especially the frontal open bite frequently observed in these patients—can exacerbate an already limited orofacial motor competence. Functional causes of disturbed mouth closure and disturbed saliva control should be determined by testing orofacial motility and lip force. Therefore, the initial multidisciplinary assessment should be carried out at an early stage with the aim of clarifying the underlying disease and the pathophysiology of hypersalivation (Crysdale et al. 2006; Steffen et al. 2011a, b). An MRI of the head should be performed, especially in children with suspected swallowing disorders due to cranial nerve damage.

In the case of suspected (micro)aspiration, respiratory problems while eating, disproportionately long meals or repeated pneumonia, patients with hypersalivation should be screened for their swallowing capacity and undergo a clinical swallowing examination (Bartolome 2014a). A phoniatic or ENT medical examination is recommended in time, including endoscopic swallowing diagnostics (Langmore et al. 1988; Schröter-Morasch and Graf 2014). In addition to neurogenic dysphagia, an ENT and/or phoniatic assessment is recommended for anatomical, morphological, functional and all other pathological abnormalities. Both for partial problems of the oral phase, e.g., a premature slipping of the bolus into the pharynx (“leaking”), and for disturbances of the pharyngeal phase of the swallowing act, such as inadequate occlusion of the laryngeal aditus with intra- and post-deglutitive aspiration, endoscopic swallowing evaluation, e.g., fibre-optic (FEES) (Fig. 1), is today an indispensable standard examination (Murray et al. 1996). The amount of accumulated saliva in the hypopharynx can be evaluated using different scales, e.g., as Murray score, and the severity of aspiration can be represented by the penetration–aspiration scale (Rosenbek et al. 1996; Neubauer et al. 2015). FEES can also be used in children (Diesener 1999; Bader and Niemann 2010; Rohrbach and Gross 2014; Reynolds et al. 2016).

In the case of suspected disorders of esophageal passage or movement disorders of the upper esophagus and sphincters, an X-ray videofluoroscopy of the swallowing act should be performed (Holzapfel 2014), since both fixed and (spastic) functional constrictions of the esophagus can be

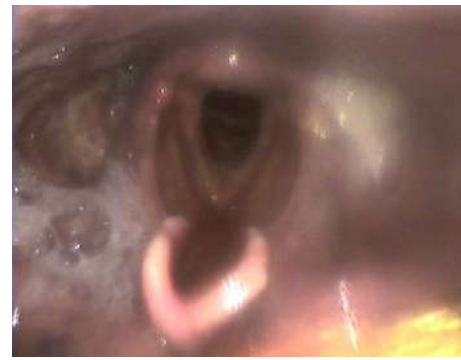


Fig. 1 Pooling saliva as dysphagia with relevant risk for chronic saliva aspiration

documented in this examination. In addition, aspirations that cannot be detected with endoscopic procedures (“white out”) can also be recorded. Both diagnostic procedures depend on a degree of cooperation and can be as complementary examinations. Recent studies have shown that in selected cases the clarification of dysphagia using real-time MR sequences is equivalent to video fluoroscopy, which may become more important in the future, especially with regard to avoiding radiation exposure (Olthoff et al. 2016a, b). In the case of ambiguous findings or persistent clinical suspicion, gastroscopy may be indicated to exclude esophageal obstructions.

Therapeutic interventions

Preferences for various treatment options differ based on the results of the diagnostics, potential underlying diseases and prior knowledge of the therapy centres. Therefore, the multidisciplinary approach and the limited amount of reliable study data for individual therapies cannot provide a generally binding therapy algorithm at this point that would do justice to all the particularities of the different therapy centres (Table 1).

Exercise treatment (functional dysphagia therapy, FDT)

If hypersalivation is caused by a disturbance in the ability to swallow saliva, there is usually also a disturbance in the intake of food and fluids (dysphagia). Early functional dysphagia therapy (FDT; Bartolome 2014b), which is oriented towards the pathophysiological causes, takes into account the frequency of aspiration due to dysphagia. The effectiveness of functional swallowing therapy in reducing the risk of aspiration has been proven (Hinchev et al. 2005; Carnaby et al. 2006). In dysphagia after a brain lesion it can be assumed that the therapy leads to a functional reorganization of the intact motor cortex (Prosiegel et al. 2008). Functional

Table 1 Examples of special therapy recommendations for different patient groups

Patient group	Treatment recommendation	Alternative treatment
Children and adolescents	Glycopyrrolate + Effect can be well titrated – Administration on a regular basis	Botulinum toxin + Long-lasting effect for months – Prolonged dosage finding for effect in individual cases
Adult patients in palliative care	Glycopyrrolate + Rapid response – Dosage limitation in renal insufficiency	Botulinum toxin + Few interactions in case of concomitant medication – Prolonged dosage finding for effect in individual cases
Parkinson's and other neurodegenerative diseases	Botulinum toxin + Few interactions in case of concomitant medication – Prolonged dosage finding for effect in individual cases	Radiotherapy + Long-lasting effect and no interaction in case of concomitant medication – The risk of inducing malignancies

Swallowing exercises are recommended as a general basic measure

dysphagia therapy can be divided into three main categories analogous to the basic principles of rehabilitation: restitution, compensation and adaptation.

The aim of restitution is a complete or partial restoration of a disturbed function. Restorative methods are performed outside the swallowing process and are therefore also referred to as “indirect swallowing therapy” (Logemann 1997). They include initiating stimuli, the reduction of pathological reflex activities, the stimulation of the swallowing reflex and the facilitation and strengthening of individual movements. The stimulation treatment is particularly important for patients without sufficient ability to cooperate. In compensation, effective and safe swallowing should be made possible by learning replacement strategies despite a remaining dysfunction. This includes head posture changes to modify the bolus passage and special swallowing techniques, which usually have to be learned first and often require a learning phase of several weeks to transfer them into real-life situations. These include effortful swallowing, supraglottic and super-supraglottic swallowing, the Mendelsohn manoeuvre and cleaning techniques to remove residuals from pharynx, larynx and trachea. Due to the complex disturbance patterns, several techniques often have to be combined. Adaptation essentially involves dietary adaptation. Since bolus volume and food consistency influence bolus transport, it is necessary to adapt them to the malfunction. In particular, changes in posture and cleaning techniques can be well verified in the FEES study.

Technically supported therapy methods can be used as a supplement to classical dysphagia therapy, e.g. biofeedback methods (surface electromyography, surface electromyography sEMG) and neuromuscular electrostimulation (NMES), (Burkhead et al. 2007; Doeltgen and Huckabee 2012; Suntrup et al. 2015; Bath et al. 2016).

If hypersalivation is accompanied by a reduced cough strike due to central or peripheral neurological diseases, the risk of tracheobronchial secretion and pneumonia is increased. To optimize secretion management, respiratory

therapeutic methods such as the mechanical insufflator-exsufflator can be used (Groß 2017).

In children, the most common cause of functional hypersalivation is insufficient orofacial muscle tone, which can lead to loss of saliva from the mouth. After careful interdisciplinary investigation and exclusion of organic disorders, the first priority is to promote perception through neurosensory stimulation in order to achieve a reflex development as normal as possible in the orofacial region. The aim of the further treatment is to optimise sensory and motor abilities, muscle tone with jaw positioning with the mouth opening, possibly including myofunctional therapy (MFT). As a new method with positive effects on orofacial motor function and a reduction of sialorrhoea, kinesio taping is described for children with basic neurological diseases (Mikami et al. 2017).

Orthodontic procedures

Orthodontic treatment makes sense in cases of dysgnathia, as malocclusion or malpositioned teeth cause a malfunction of the orofacial motor system and thus intensify hypersalivation. Obstruction of nasal breathing as the cause of a skeletal jaw malposition should be excluded as far as possible in this context. Palatal stimulation plates according to Castillo-Morales are a supportive therapy option for patients with malpositioned jaws, especially skeletal ones, with accompanying hypersalivation. They may also contain modifications to stimulate lip closure such as mouth vestibular braces (Hussein et al. 1998). Stimulation of the tongue by elements attached to the palatal plate act as a functional therapy to correct the frontally open bite and can reduce hypersalivation through increased mouth closure and improved tongue base (Limbrock et al. 1990). An integration of the stimulation plates into an exercise treatment to improve swallowing as a multimodal therapy concept is useful. A decisive prerequisite for the successful implementation of regular

orthodontic therapy is both the willingness of globally developmentally delayed children and the acceptance of their parents for this treatment (Becker et al. 2000; Abeleira et al. 2014).

Drug treatment strategies

Almost all of the substances listed below have no approval for the treatment of hypersalivation, therefore, in the off-label use situation, potential recourse by the insurance company must be considered, especially in outpatient treatment (German health system). In the case of a lack of approval, the physician should obtain written consent from the insurance company. The age of the patient must also be taken into account, as a drug may be approved for the treatment of children, but not for the treatment of adults.

Drug therapy for hypersalivation consists of the inhibition of salivary secretion by anticholinergic muscarinic receptor antagonists. It can be administered per os, intravenously, intramuscularly, transdermally or quasi-locally (e.g., sublingual application of drops or spray). The requirements for anticholinergic substances apply to children as well as adults, although the psychopharmaceuticals among these substances are usually only recommended for adults. In Germany, atropine, scopolamine and glycopyrrolate have been used so far.

Atropine and its derivatives are among the most frequently used substances in hypersalivation, despite only a few studies showing evidence of an effect (Hyson et al. 2002; De Simone et al. 2006; Matos Santana et al. 2017). Application can be as drops per os, sublingual, subcutaneous or intravenous. Scopolamine can be given in different forms: transdermally applied scopolamine shows slow, continuous drug release and may remain adherent for several days. As a specially prepared aqueous solution, scopolamine can be taken orally or via PEG, thus taking into account variations in saliva production over the course of the day (Fischbacher and Schröter-Morasch 2003). Glycopyrrolate has the advantage of at reduced central nervous side effects, since, in contrast to other anticholinergics, it hardly crosses the blood–brain barrier (Blasco and Stansbury 1996; Bachrach et al. 1998; Mier et al. 2000; Blissit et al. 2014; Praharaj et al. 2014; Parr et al. 2014; Banfi et al. 2015; Qurashi et al. 2016; Lee et al. 2017; Man et al. 2017). In September 2016, the European Medicines Agency (EMA) granted a Europe-wide approval for the symptomatic treatment of severe hypersalivation in children and adolescents from the age of 3 years in a licensing procedure (PUMA—Pediatric Use Marketing Authorisation). PUMA is a specially established process to license medicine previously used off-label in pediatrics; Sialanar® (320 µg/ml glycopyrronium) is only the third drug to be licensed through this procedure.

In randomized, controlled trials, the positive benefit with a good side-effect profile has been demonstrated (Zeller et al. 2012a, b). Clear dosage tables depending on body weight and kidney function can be found in the package insert. The preparation is a solution for ingestion, for which a dosage aid is supplied, and has been available in Germany on a regular basis since spring 2018. For adults, the ongoing off-label use situation must be taken into account as for all drug therapies.

Death rattle breathing is a common symptom in people in the dying phase, which is less a burden on those dying who are already clouded by consciousness than on their relatives (S3 guideline palliative medicine 2015). Here various short-acting drugs are used subcutaneously such as atropine, scopolamine and glycopyrrolate, the latter also being prescribed as a permanent intravenous application (Wildiers et al. 2009). If such use is considered appropriate, early administration of medication is recommended.

The side effect spectrum and contraindications of most anticholinergic substances limit their application such as accommodation disorders with visual disturbances, constipation, urinary retention due to changes in parasympathetically mediated muscle activity, sedation, confusion or excitability (Leung and Schak 2017). There is also a risk of cognitive changes with regular administration (Sittironnarit et al. 2011). Anticholinergic substances are contraindicated in patients with, e.g., narrow-angle glaucoma, myasthenia gravis and a history of urinary retention.

Injection of botulinum toxin into the salivary glands

The intraglandular injection of botulinum toxin, mostly of serotype A, into the large salivary glands significantly and reversibly reduces the activity of the salivary glands by inhibiting the cholinergic neuroglandular transmission (Ellies et al. 2002a, b; Ondo et al. 2004; Lim et al. 2006; Wilken et al. 2008; Guidubaldi et al. 2011; Wu et al. 2011; Schroeder et al. 2012; Vashishta et al. 2013; Lakraj et al. 2013; Verma and Anand 2017). Botulinum toxin A and B have also been successfully used in drug-induced hypersalivation (Kahl et al. 2004, 2005; Steinlechner et al. 2010). To reduce both the resting and stimulated secretion of the salivary glands, a combined injection of the submandibular and parotid glands is necessary. Sonographic control is particularly useful in the treatment of the submandibular salivary gland, as swallowing disorders caused by unintentional diffusion into the muscles of the oral floor can be avoided (Jost 2016). Standardized documentation sheets can be used for better comparability and therapy control. The injection of botulinum toxin A into the salivary glands can be used in all patient groups and different age groups with hypersalivation. The advantage of the duration of the effect

of about 10–14 weeks should be considered especially in an improved ambulatory care situation. In the long-lasting phase of reduced hypersalivation, intensified or previously impossible, due to saliva aspiration, therapeutic swallowing exercises can have a decisive effect on the underlying dysphagia. In the long-term care of patients, dose adjustments are not unusual and in some cases high doses are necessary for the desired effect (Steffen et al. 2015). In patients with head and neck tumors and hypersalivation, compromises may have to be made in the sense of overdosage to avoid the saliva becoming too viscous. This can be particularly problematic for tracheal cannula users (Steffen et al. 2014). In the case of a disorder of the upper esophageal sphincter opening as the main cause of the swallowing disorder of the saliva, there may be an indication for a botulinum toxin injection at this site (Alberty et al. 2000; Rohrbach and Laskawi 2004; Del Tredici and Jost 2012).

The recently completed approval study for incobotulinum toxin A in hypersalivation could, assuming a positive evaluation by the EMA, for the first time explicitly approve a drug for this clinical picture in adults, which would be of enormous importance and treatment safety with regard to the liability assessment and recourse situation in the outpatient sector (Jost et al. 2018). In the summer of 2018, Incobotulinumtoxin A was the only botulinum toxin preparation in the USA to receive approval for hypersalivation without restrictions on the underlying cause. The recommended treatment dose is a total of 100 units, divided into the parotid glands with 30 units each and the submandibular gland with 20 units each and the possible repetition after 16 weeks. From October 2014 to May 2018, an international, randomized, placebo-controlled phase III registration trial with incobotulinum toxin A (NCT02270736) has been conducted for patients between 2 and 17 years of age.

Surgical interventions

Significantly restricted nasal breathing can contribute to hypersalivation due to altered orofacial motor function with increased mouth opening. In principle, however, the saliva-reducing effect should be evaluated cautiously and critically against the background of a surgical intervention under intubation anesthesia with the associated risks when determining the indication for the respective rhinosurgical procedures or (adeno-) tonsillectomies. In very young children, the disturbance of the oral function should be excluded prior to surgical intervention and, if confirmed, functionally treated. Functional therapy reduces the need for surgical intervention (Limbrock 2017; Marinone et al. 2017).

If the surgical salivary gland interventions are considered, the submandibulectomies and different forms of resection or ligation of the excretory duct as well as the displacement

of the excretory ducts of the large salivary glands should be considered (Crysdale and White 1989; Mankarious et al. 1999; Uppal et al. 2003; Martin and Conley 2007; Katona et al. 2008; Reed et al. 2009; Becmeur et al. 2013; Formeister et al. 2014). Besides submandibulectomy, the current literature focuses on the displacement of the excretory ducts of the Gll. submandibulares—Wharton ducts—and the ligation of the ducts of the Gll. parotidaeae—Stennon ducts (Becmeur et al. 2013; Formeister et al. 2014; Noonan et al. 2014; Kok et al. 2016). Since the non-stimulated basal salivary secretion of the Gll. submandibulares is directed into the hypopharynx, the risk of aspiration is clearly increased and has to be clarified in advance. In cases of therapy-resistant opening disorders of the upper esophageal sphincter (OES) or recurrent symptoms after botulinum toxin injection, bougienage treatments or cricopharyngeal myotomy may be considered (Feussner and Schröter-Morasch 2014; Lawson and Remacle 2006). Should orthodontic treatment improve the symptoms of a frontally open bite, additional surgical intervention in the form of an osteotomy of the upper and/or lower jaw should be considered.

External irradiation of the salivary glands

Irradiation of the salivary glands (especially the glandula parotis) can lead to xerostomia; previously this was a common side effect of radiotherapy of head and neck tumors. The benefits of external irradiation have been described for hypersalivation in various neurological conditions (Borg and Hirst 1998; Andersen et al. 2001; Neppelberg et al. 2007; Postma et al. 2007; Seegenschmiedt et al. 2008). Assouline et al. (2014), were able to show a good therapeutic effect with moderate side effects at a dose of 20 Gy under modern 3D-conformal irradiation technique and maximum protection of the surrounding tissue. In a small randomized study, irradiation compared with an injection of botulinum toxin was compared in ten patients with ALS. After 4 weeks there was no difference in efficacy although after 12 weeks salivary reduction was significantly greater after irradiation than after botulinum toxin. Severe side effects were not observed, but more patients reported side effects after irradiation than after botulinum toxin directly after treatment, here seven patients versus one patient (Weikamp et al. 2016). Irradiation can also reduce hypersalivation or suspend postoperative salivary fistulas after unsuccessful treatment with botulinum toxin (Christiansen et al. 2009; Laskawi et al. 2013; Hawkey et al. 2016) and, conversely, postradiogenic hypersalivation can be reduced by injection of botulinum toxin (Steffen et al. 2011b). While the basic efficacy and long-lasting effect are undisputed, the possible side effects as well as the carcinogenic potential have to be considered.

Monitoring of treatment success and follow-up examinations

Documentation is required to record the desired and undesired effects, complications, and patient cooperation (“compliance/adherence”) that cannot be accurately predicted by the individual patient. Treatment schemes from the aforementioned therapy options are a guideline (American Academy for Cerebral Palsy and Development 2017), although this does not necessarily reflect a consideration of the individual patient situation and wishes or the institution-specific capabilities and experiences (Table 1). In each treatment procedure, saliva aspiration must be assessed again if a clinical suspicion exists. In the phase of reduced saliva production, therapeutic swallowing exercises should be accelerated where there is dysphagia. If necessary, more intensive exercises can be performed which were previously not possible due to the increased risk of aspiration and the amount of saliva. With recurrence of hypersalivation, in the case of non-response to the selected therapy procedure or in case of a change in the respective underlying disease, a renewed interdisciplinary diagnosis should be carried out. The time intervals for the follow-up examinations should take into account the dynamics of the underlying disease and the overall development, especially in children and adolescents.

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