S. Saccomanno*, C. Martini**, L. D'Alatri***, S. Farina****, C. Grippaudo*

Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome Università Cattolica del Sacro Cuore
** Dental Institute, Head and Neck Department, Università Cattolica del Sacro Cuore*
*** Dental Institute, Università Cattolica del Sacro Cuore*
**** ENT, Head and Neck Department - Università Cattolica del Sacro Cuore*
***** ENT, Head and Neck Department*

email: sabinasaccomanno@hotmail.it

DOI: 10.23804/ejpd.2018.19.03.14

A specific protocol of myo-functional therapy in children with Down syndrome. A pilot study

ABSTRACT

In this article the authors propose a specific myofunctional therapy protocol for children with Down syndrome. For these patients, who usually present with atypical swallowing problems, mouth breathing and lip incompetence, the use of a myofunctional therapy protocol with specific exercises has been shown to improve orofacial and nasal functions. In addition to the functional results, such as the correction of the atypical swallowing, restoration of lip competence, breathing improvement and reduction of nasal rhinorrhea, there were also aesthetic results. This protocol can be useful to improve the quality of life of these patients.

Keywords *Atypical swallowing, Down Syndrome, Mouth breathing, Myofunctional therapy.*

Introduction

Down syndrome is by far the most common chromosomal abnormality affecting live born children. It is primarily caused by trisomy of chromosome 21 and it is characterised by mild to moderate mental retardation and physical deficits. Affected individuals most often exhibit systemic abnormalities (cardiovascular, neurological, immunological, musculoskeletal) as well as anomalies of the orofacial complex, the most frequent ones are:

- skeletal abnormalities such as deficit development of the middle third of the face resulting in mandibular prognathism, skeletal open bite, deep and narrow palate;
- dental anomalies of shape, such as macrodontia or microdontia (often the upper lateral incisors, if present, are peg-shaped), number, such as agenesis of teeth (especially of the upper lateral incisors), and eruption, such as delayed eruption or teeth that erupt in a different order than in healthy children [Kumasaka et al., 1997; Mestrovic et al., 1998].

Patients with Down syndrome have periodontal disease [Shapira et al., 1991; Agholme et al., 1999; Sohoel et al., 1995; Cichon et al., 1998], with the mandibular incisors and the maxillary molars being the most commonly affected teeth. Cavities are rather less frequent than periodontal disease or functional problems. Patients with Down syndrome present mouth breathing, which is a consequence of the small size of the nasal cavity, but it is probably also due to continuous infection of the upper airways that force the patient to breathe through the mouth. Mouth breathing often causes problems of halitosis (bad breath) and dry mouth (xerostomia) as well as angular cheilitis, often also due to sialorrhoea. Patients often present with macroglossia. It is, however, an apparent macroglossia due to the small size of the palate that forces the tongue to maintain a low and forward position. Patients with Down syndrome have significant problems in sucking, swallowing, chewing and talking.

Materials and methods

The study comprised patients in treatment for dental problems at the Gemelli University Hospital at the beginning of myofunctional treatment. Inclusion criteria were: Diagnosis of Down syndrome, malocclusion, atypical swallowing, mouth breathing, muscular hypotonia, rhinorrhoea, sialorrhoea, snoring, dry lips and lip incompetence. Exclusion criteria were: Patients or guardians non compliant and patients unable to pass the comprehension and language tests. Patient enrollment was completed with a cognitive assessment, an evaluation of language skills, both receptive and expressive, and a tongue-mouth-face praxis examination through the following standardised tests.

- Language articulation test [Fanzago, 1983].
- Phrases repetition test [Zardini, 1981].
- Praxis test (Smith).
- Morphosyntactic comprehension test [Rustioni, Metz Lancaster 2007].

All evaluations were conducted by the same speech-language pathologist, not involved in this study, who

has experience in working with children with Down syndrome. This one-on-one 45 min assessment was carried out in four sessions, so even patients with a reduced attention span were able to complete the tests. The resulting selected group of patients had a good verbal comprehension based on simple commands, a satisfactory praxis and minimal articulatory difficulty.

Eventually, the selection of subjects yielded a final sample of 10 patients (7 males and 3 females), aged between 9-18 years. Figure 1 shows that 4 had a good degree of collaboration, 4 had a sufficient degree of collaboration, and only 2 had an insufficient degree of collaboration and required additional coaching. The sample underwent myofunctional assessment [Saccomanno et al., 2012a, 2012b, 2014], including the following.

- Intraoral and extraoral photographs.
- Fluorescein test (according to Garliner therapy) [1974].
- Evaluation of the orbicularis oris muscle strength using a dynamometer (according to Garliner therapy).
- Glatzel nasal mirror test for nasal patency.

The treatment protocol developed for this pilot study included a series of exercises for myofunctional rehabilitation divided according to the functional goals to be pursued. Each of these goals included a series of about 5 exercises. Our protocol provided treatment lasting about twenty weeks, each week the child was given one/two goal exercises. At home the child had to repeat each exercise at least 3 times a day, so that every day the child performed at least 30 min of myofunctional therapy. In order to make the exercises more pleasant, and increase compliance, children performed them during everyday activities such as drawing or watching TV.

First goal: awareness of the nose's functionality

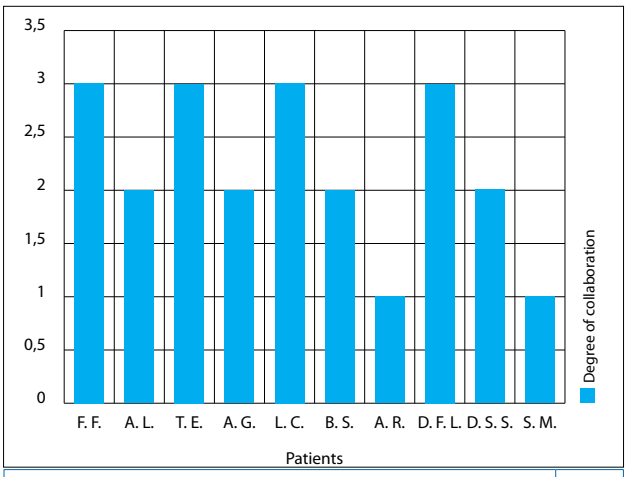
It is important for the child to follow the nasal hygiene rules: washing techniques for the nasal passages and learning how to blow one's nose properly to remove excess discharge.

Second goal: promoting nasal breathing

Commonly, patients with atypical swallowing are also often unable to breathe through the nose (and the reverse is true as oral breathing is often associated with an atypical deglutition). There are exercises that train the child to breathe through his/her nose, they aim at re-train the brain into establishing a new, more physiological routine, through principles of neuroplasticity, therefore requiring multiple repetition of the new habit (nasal breathing, lips closed) over time until it is formed. Children must keep their mouths closed and inhale and exhale, keeping a tongue depressor between their lips (Fig. 2A).

Third goal: establishing tongue rest position

The child, through a series of exercises, starts stimulating first the anterior portion of the tongue, then the lateral portion, and finally the posterior one. Through



mean	250
standard deviation	350
median	250

FIG. 1 The degree of collaboration of the patients selected.

these exercises the child learns to rest the tongue against the palate (Fig. 2B, C, D). The tip of the tongue will rest on the retroincisal papilla with the remaining portion of the tongue resting on the palate. A tongue at rest against the palate facilitates restoration of the lip seal and nasal breathing.

Fourth goal: restoring the lips seal

In people with atypical swallowing, the swallowing mechanism includes a compensatory excessive contraction of the orbicularis oris, to prevent the food bolus from escaping. However, at rest the lips are open and the oral seal is defined as incompetent. It is important to restore a proper lip seal at rest through exercises to facilitate a correct swallowing pattern as well as promoting nasal breathing and a physiological postural position of the mandible (Fig. 2E).

Fifth goal: improving function of buccinator and masseter muscles

Atypical swallowing is a result of incorrect functionality of the masticatory and facial muscles and often patients present reduced muscle tone. In patients with Down syndrome, a reduced tone of the facial and chewing muscles is a characteristic feature, and it is therefore imperative to restore their function to improve chewing, swallowing, jaw stability and esthetics (Fig. 2F).

Sixth goal: strengthening the soft palate

The soft palate in patients with Down syndrome is often hypotonic. The persistence of such a reduced tone may contribute to oral breathing. The exercises that teach children to raise and lower the soft palate are gargling and energetic pronunciation of vowel phonemes and single vowels (Fig. 2G). These exercises

FIG. 2A Breathing exercises.

FIG. 2B Anterior tongue exercises.

FIG. 2C Medium tongue exercises.

FIG. 2D Posterior tongue exercises.

FIG. 2E Labial skills improvement.

FIG. 2F Chewing exercises.

FIG. 2G Streightening soft palate exercises.

FIG. 2H Swallowing exercises.

FIG. 2I Cheek exercises.

FIG. 2 Exercises for myofunctional rehabilitation.

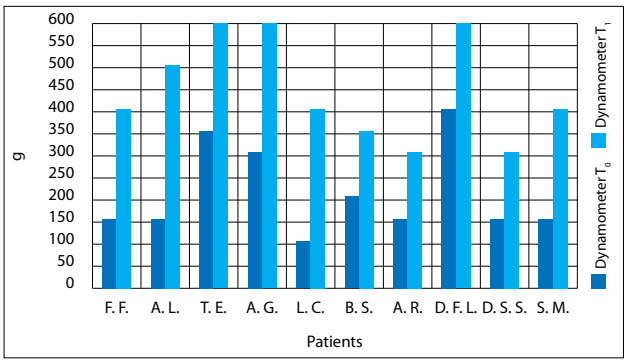


FIG. 3 Measurements of the orbicularis oris muscle strength before (T0) and after (T!) myofunctional treatment.

should be performed with an open mouth.

Seventh goal: re-patterning a correct swallowing

Once the resting tongue position is established, along with a good lip seal and a good chewing pattern, the last goal focuses on re-patterning the tongue movement to achieve adequate swallowing.

Results

From the results obtained it can be inferred that myofunctional therapy gives excellent results (Fig. 3), if the protocol is properly executed and customised. For this reason we selected some easy-to-perform exercises to be placed in a specific protocol for patients with Down syndrome.

- Goal N. 1: All 10 subjects demonstrated their ability to independently clean and free the nasal passages through blowing their noses or performing nasal rinses.
- Goal N. 2: At the end of the therapy cycle, all 10 subjects were able to breathe nasally habitually.
- Goal N. 3: Four out of 10 patients were able to keep their tongue up against the palate, at rest, habitually, as per a visual spot check and patient's report. However, this particular tongue position requires a certain width of the palate that was not present in most patients.
- Goal N. 4: Using the labial button to increase the coordination and strength of the perioral muscles (Fig. 1), the lip seal during eating was achieved by all patients, but the habitual lip seal at rest, although present in all patients, was still inconsistent.
- Goal N. 5: Since improving the tone of the masseters means improved chewing, all patients improved chewing of foods such as lettuce or meat or the comminution of food was more thorough, or eating a meal took significantly less time, as per parents' reports.
- Goal N. 6: By observation, at the end of the therapy, all patients demonstrated increased mobility of the soft palate, eliminating those cases of hyper nasal resonance and reducing the episodes of snoring, as per caregivers' report.
- Goal N. 7: All 10 patients solved their atypical swallowing, reducing episodes of sialorrhoea, rhinorrhea, or angular chelitis.

Overall, all patients expressed satisfaction with their performance and new appearance.

The results also show that, after a cycle of myofunctional therapy, the strength of the orbicularis oris muscle increased (Fig. 3) and a good lip seal was obtained in all patients. All the patients became aware of the correct posture for breathing and swallowing, thus resulting in the reduction of salivary and nasal secretion (Fig. 4, 5).

Discussion

This original pilot study is particularly important if

FIG. 4A Case 1 before treatment.

FIG. 4B Case 1 after treatment.

FIG. 5A Case 2 before treatment.

FIG. 5B Case 2 after treatment.

we consider the paucity of references regarding the application of myofunctional therapy in children with Down syndrome. Myofunctional therapy yielded multiple results by improving the orofacial and nasal functions as well as the facial appearance. Lips competence along with the correction of atypical swallowing creates an oral seal, and helps breathing through the nose, with improved tonicity of the lips and subsequent reduction of angular cheilitis. All these improvements change the typical facial features (Fig. 4A-B, 5A-B) of patients with Down syndrome, improving their social life.

Conclusions

The results of this study treating nasal-oral atypical functions with myofunctional therapy in patients with Down syndrome has been very positive, and allow us to state that, in selected cases, it is possible to achieve proper restoration of the orofacial physiological kinetics and to normalise oral functions such as swallowing, breathing and articulation although, in the present study, speech was not a therapy goal. Myofunctional therapy should be considered not only as an adjunct to orthodontic treatment, but also as an essential support to the development of the cranio-mandibular-occlusal complex [Saccomanno et al., 2012a, 2012b, 2014]. A multidisciplinary approach and cooperation between the medical staff and the patient as well as his/her family is necessary to ensure compliance at home to perform the exercises that are crucial to the success of the treatment.

This study showed that good results can be achieved with two specific and properly performed cycles of myofunctional therapy. With this group of patients, the number of repetitions of exercises and the length of the therapy were sufficient to allow a neuroplastic and neuromuscular result, visible in facial posture, nasal breathing and oral functions. Therefore, it is of paramount importance to begin therapy with children with Down syndrome as soon as possible in order to ensure the maximum benefit of myofunctional therapy, to establish normalised orofacial and nasal functions and thus improve their social life.

A major concern is a relapse at the conclusion of therapy and, for this reason, it is important to provide a maintenance protocol to achieve stability of results over time. This therapy should include regular meetings between the multidisciplinary team, the patients and the family members assisting them in daily life. This therapy is easy to learn and to perform, even by patients with slight mental retardation, and it is based on simple functional and coordinated movements of the different orofacial muscle segments, which may become more complex and effortful if patients are treated later in life.

Acknowledgments

We would like to thank Licia Coceani Paskay, MS, CCC-SLP, Los Angeles, CA, USA, for her expert advice and contribution.

References

› Agholme MB, Dahllof G, Modeer T. Changes of periodontal status in patients with Down syndrome during a 7-year period. Eur J Oral Sci 1999;107(2):82-8.
› Cichon P, Crawford L, Grimm WD. Early-onset periodontitis associated with Down's Syndrome-clinical interventional study. Ann Periodont 1998; 3(1):370-80.
› Fanzago F. Test di valutazione dell'articoloazione. Quaderni Acta Phoniatrica Latiba 1983; 2:80-5.
› Garliner D. Myofunctional Therapy in dental practice. Brooklyn: Bartel Dental Book Co.; 1974.
› Kumasaka S, Miyagi A, Sakai N, et al. Oligodontia: a radiographic comparison of subjects with Down Syndrome and normal subjects. Spec Care Dent 1997;17(4): 137-41.
› Mestrovic SR, Rajic Z, Papic JS. Hypodontia in patients with Down's Syndrome. Coll Antropol 1998; 22:69-72.
› Rustioni Metz Lancaster D. Test di Comprensione Morfosintattica [Grammar Comprehension Test]. Florence: Giunti Organizzazioni Speciali; 2007.
› Saccomanno S, Antonini G, D'Alatri L, D'Angelantonio M, Fiorita A, Deli R. Patients treated with orthodontic-myofunctional therapeutic protocol. Eur J Paediatr Dent 2012a;13 (3): 241-3.
› Saccomanno S, Antonini G, D'Alatri L, D'Angelantonio M, Fiorita A, Deli R. Causal relationship between malocclusion and oral muscles dysfunction: a model of approach Eur J Paediatr Dent 2012b; 13 (4): 321-3.
› Saccomanno S, Deli R. Terapia miofunzionale e ortognatodonzia. Milano: Edi-ermes; 2014.
› Shapira J, Stabholz A, Schurr D, et al. Caries level, Streptococcus mutans counts, salivary pH, and periodontal treatment needs of adult Down Syndrome patients. Spec Care Dent 1991;11(6):248-51.
› Simons WS, Fuggle PW, Grant DD, Smith I. (1997) Educational progress, behaviour and motor skills at 10 years in early treated congenital hypothyroidism. Archives of Disease in Childhood 77: 219–22.
› Sohoel PD, Johannessen AC, Kristoffersen T et al. Expression of HLA Class II antigens in marginal periodontitis of patients with Down's Syndrome. Eur J Oral Sci 1995;103:207-13.
› Vender C, Borgia R, Cumer Bruno S, Freo P, Zardini G. Un test di ripetizione di frasi. Analisi delle perfonmances di bambini normali. Neuropsichiatria infantile 1981; 243-244: 819-831.