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Case report

Speech-language evaluation and rehabilitation treatment in Floating-Harbor syndrome: A case study

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Abstract

Floating-Harbor syndrome is a rare congenital disorder characterized by specific facial features, short stature associated with significantly delayed bone age and language impairment. Although language delay is a cardinal manifestation of this syndrome, few reports describe the specific language difficulties of these patients, particularly the development of language abilities in the long run. This paper reports on an Italian boy with Floating-Harbor syndrome and discusses his language evaluation at presentation (age 48 months) and development and progress of his language abilities after 4 years of rehabilitation treatment. At presentation he exhibited borderline mental retardation, with verbal abilities lower than performance abilities. He showed significant impairment of both expressive and receptive language, and also exhibited phonologic and articulations problems that lowered speech intelligibility. Neuropsychological assessment revealed cognitive problems. After speech-language rehabilitation treatment, he achieved significant improvement in language function.

Learning outcomes: The reader will learn about (1) the distinctive clinical characteristics and (2) the speech-language abilities and their development after speech-language therapy in Floating-Harbor syndrome.

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1. Introduction

Floating-Harbor syndrome (FHS) is a rare disorder that derived its name from two hospitals (Boston Floating Hospital and Harbor General Hospital, California) where the first two cases were described by Pelletier and Feingold in 1973 and Leisti et al. in 1974. As of this writing, only 29 cases have been described in the literature.

The syndrome is characterized by specific facial features (triangular face, broad and bulbous nose, smooth and short philtrum with thin upper and lower lips, wide mouth, long eyelashes, deep-set eyes), together with short stature associated with delayed bone age, and language delay (Robinson et al., 1988). Most of the reported cases have been female; the male:female sex ratio is 7:22 (Bastaki et al., 2007).

Other associated anomalies include feeding difficulties, fifth finger clinodactyly (Lacombe, Patton, Elleau, & Battin, 1995; Majewski & Lenard, 1991), finger clubbing, clavicular pseudarthrosis, celiac disease (Chudley & Moroz, 1991; Houlston, Collins, Dennis, & Temple, 1994; Penaloza et al., 2003), a high-pitched voice (Ala-Mello & Peippo, 1996; Hersh, Groom, Yen, & Verdi, 1998; Patton et al., 1991), structural malformations including tethered cord

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(Wiltshire, Wickremesekera, & Dixon, 2005), congenital heart disease (Lazebnik, McPherson, Rittmeyer, & Mulvihill, 1996; Patton et al., 1991) and genito-urinary anomalies (Leisti, Hollister, & Rimoin, 1975).

Cognitive abilities have ranged from normal intelligence to mild mental retardation (Ala-Mello & Peippo, 2004; Feingold, 2006; Hersh et al., 1998; Rosen et al., 1998).

The cause of this syndrome is presently unknown and most of the cases have been sporadic. Lacombe et al. (1995) described the possible phenotypes of FHS in their patient's mother, which suggests a dominant mode of inheritance. Penaloza et al. (2003) described a boy with clinical features of FHS and celiac disease and observed that his mother also presented minor phenotypical characteristics, suggesting that their observation corresponded to a variant example of familial FHS. Ioan and Fryns (2003) reported two sisters with FHS suggesting an autosomal recessive inheritance or a germinal mosaicism for an autosomal dominant gene mutation.

The diagnosis is presently based on the clinical triad of facial features, short stature with delayed bone age and language delay. Lack of a confirmatory laboratory test underlines the importance of adhering to typical signs when making the diagnosis.

Although language impairment is a consistent feature of FHS, few studies have investigated the specific speech and language characteristics associated with this syndrome and only poor information is available. These reports suggest only that speech and language development in individuals with FHS is characterized by significant expressive language deficits. Other findings have included hypernasality, phonological deficits and oral motor dysfunction (Ala-Mello & Peippo, 1996; Davalos et al., 1996; Fryns, Kleczkowska, Timmermans, & van den Berghe, 1996; Hersh et al., 1998; Houlston et al., 1994; Leisti, Hollister, & Rimoin, 1974; Patton et al., 1991; Pelletier & Feingold, 1973). Also dental abnormalities, mostly described as malocclusion, are common in FHS (Ala-Mello & Peippo, 1996, 2004; De Benedetto et al., 2004; Patton et al., 1991).

Little information is available on speech and language development and treatment in individuals with FHS. Hersh et al. (1998) re-evaluated a girl with FHS at age 12 years and 2 months. At presentation she had average intellectual abilities, attention deficit hyperactivity disorder, expressive language delays, and hypernasality. She had received speech and language therapy since early childhood and was receiving special educational services as she had evidence of a learning disability. She was treated with Ritalin for attention deficit hyperactivity disorder. At the re-evaluation her communication skills improved but she still had speech deficits and hypernasality. Ala-Mello and Peippo (2004) reported the follow-up data on the first Finnish patient with the FHS at the age of 14 years. The authors found that after speech therapy the high pitch, weakness and nasality were no longer so pronounced, although his voice was still weak. He had attended a special school and deficits in attention were his main problem, but were no longer so pronounced at the age of 14 and he was placed in a normal class. Finally, Feingold (2006) discussed a 32-year follow-up of the first patient reported with the FHS, saying ''he attended special educational classes for 12 years. Presently, he reads a limited number of basic words''.

The purpose of this study was to describe the speech-language skills present in an Italian-speaking child with Floating-Harbor syndrome and his progress after a specific rehabilitation program.

2. Case presentation

This child was born at 38 weeks gestation by cesarean section after an uncomplicated pregnancy to non-consanguineous parents with an unremarkable family history. Birth weight was 2.7 kg and length was 46 cm. His neonatal course was normal: Apgar scores were 8 and 9, at 1 and 5 min, respectively. He walked at approximately 14 months of age.

He was noted to have growth retardation during the first years of life with progressive reduction of growth velocity. An endocrine assessment for short stature was undertaken at the age of 3 years. His height was 86 cm, <3rd centile according to Tanner and Whitehouse (1976), his weight was 12 kg, <3rd centile according to Tanner and Whitehouse (1976), with a bone age of 1 year, 9 months. The mid-parental height was 167 cm, 10th–25th centile, according to Tanner and Whitehouse (1976). Thyroid function was normal. A growth hormone (GH) stimulation test with arginine and insulin showed a significant GH deficit and therapy with recombinant GH was started.

A genetic evaluation was performed and he was noted to have the typical facial features of Floating-Harbor syndrome. He had a triangular face, bulging and narrow forehead, broad and bulbous nose with a prominent nasal bridge, wide columella, smooth and short philtrum, thin upper lip, wide mouth, long eyelashes, posterior rotated ears, short neck, low posterior hairline, small hands. He also had language delay.

Several investigations were carried out. Magnesium, blood glucose, ToRCH assay, immunoglobulin electrophoresis, amino acid chromatography and organic acids assay were normal. IgA antigliadin was negative. Chromosomal examination, hearing and vision were normal. Microdeletion of 22q11 was excluded by routine FISH. Echocardiography, computerized tomography of the head and magnetic resonance imaging were normal. No other abnormalities were found.

A diagnosis of Floating-Harbor syndrome was made on the basis of his short stature associated with delayed bone age, typical facial dimorphism and delayed language development.

3. Speech-language evaluation

The patient started to speak at about age 48 months. Prior to this age, he had minimally symbolic communication, using primarily concrete symbols to communicate (e.g., eat, drink, play).

At 48 months of age he was enrolled in speech-language therapy because of delayed language onset. He produced disyllabic utterances and one-word sentences. Oral motility and phonetic-phonological abilities were impaired. At the same time he was also given psychomotor therapy because he showed delayed eye-hand coordination and fine motor function, motor instability, hyperkinetic conduct, poor attention and moodiness.

3.1. Language

Language was tested using a standardized test for Italian preschool children, TVL – Test di Valutazione del Linguaggio (Cianchetti & Sannio Fancello, 1997). This test is organized in 4 sections that study respectively:

1. Receptive language. This section studies the comprehension of both words and sentences. Word comprehension is assessed using pictures representing body parts, common objects, colours, adjectives. Sentence comprehension is assessed using pictures representing actions, objects and spatio-temporal concepts;
2. Sentence repetition ability. This ability is evaluated by asking the child to repeat 15 sentences of increasing length;
3. Naming ability. This ability is evaluated by asking the child to name pictures representing body parts and common objects;
4. Spontaneous language production. The purpose of the language sample is to assess language skills in a spontaneous context, asking the child to describe pictures representing actions, scenes, stories, and to tell sequence actions of his life. The sample so obtained is used to evaluate phonologic and morphosyntactic abilities and the ability to enrich sentence structure using adjectives, adverbs, indirect objects, and subordinate clauses.

The results for each evaluated ability are expressed as language age in months.

Table 1 shows child's language assessment at age 48 months, using TVL.

The evaluation of receptive language showed a moderate delay in the comprehension of words (age 36–41 months) and especially sentences (age 30–35 months) compared to his chronological age. He understood only few body parts,

Table 1
Results of child's language assessment at 48 months (Test TVL – Test di Valutazione del Linguaggio, a standardized test for Italian language assessment).

	Raw score	Language age (months)
Receptive language		
Words	50	36–41
Sentences	17	30–35
Total	67	30–35
Sentence repetition	5	30–35
Naming	13	<30
Phonological proprieties	3	<30
Morphosyntactic proprieties	2	<30
Sentence production	0	<30

Table 2
Child's lexical abilities at 48 months (Test PFLI – Prove per la valutazione Fonologica del Linguaggio Infantile, an Italian picture naming test).

	Number	%
Correctly pronounced words	25	20
Simplified words	42	33.6
Unintelligible words	58	46.4
Total words	125	

common objects and adjectives and he was not able to recognize colours. The comprehension of sentences regarding actions and spatio-temporal concepts was severely impaired. The total receptive language age was 30–35 months.

Sentence repetition ability was also impaired with language age of 30–35 months. He was able to repeat correctly only short sentences (consisting of two or three words). In the repetition of longer sentences, he omitted one or more words and revealed speech sound disorders.

Expressive language ability was severely impaired. He was able to name only few body parts and common objects (naming age <30 months) and his intelligibility was poor (phonological age <30 months). The sentence production ability was so delayed (age <30 months) that he produced only one-word sentences and used mimicry and gestures to communicate.

3.2. Speech

Speech function assessments included voice, oromotor function, articulatory and phonological skills.

The voice assessment consisted of both a perceptual and an acoustic analysis. Perceptual rating of voice quality using the GRBAS scale (Hirano, 1981) indicated that voice quality was normal. Acoustic analysis (Computerized Speech Lab, Kay Elemetrics Corporation, Model 4300) based on 5 s sustained vowel phonation of the [a] yielded jitter and shimmer values which fell within the normal range. Fundamental frequency was normal. Nasolaryngoscopic evaluation of the vocal folds showed absence of any organic or functional disorder.

Oromotor function showed open bite malocclusion, slow oral motor speed, poor coordination and hypomobility of the palate with moderate nasal emission on all pressure sounds.

For the assessment of articulatory and phonological skills, a speech sample was gathered by means of an Italian picture naming test, PFLI – Prove per la valutazione Fonologica del Linguaggio Infantile (Bortolini, 1995). The test provides an adequately extensive speech sample supplying both word and context testing results. It is important to obtain the highest intelligibility, asking the child to repeat if necessary. Sampling took place in a sound protected room and was video-recorded for further analyses. The listeners transcribed the taped speech samples using the symbols and diacritics of the International Phonetic Alphabet (IPA) and the extended IPA (International Phonetic Association, 1999; Ball, Rahilly, & Tench, 1996).

Table 2 illustrates the lexical level of the subject's sample obtained using PFLI, showing the total number of produced words and the number and percentage of correctly pronounced, simplified and unintelligible words. The patient produced only 125 words with an high percentage of simplified (33.6%) and especially unintelligible words (46.4%).

The patient was capable of producing all the 7 Italian vowels. The consonant inventory was very incomplete as shown in Table 3: only the plosives /t/ and /p/, the nasals /m/ and /n/, the affricate /t∫/ were correctly produced, both in

Table 3
Child's consonant inventory according to position in word at 48 months (Test PFLI – Prove per la valutazione Fonologica del Linguaggio Infantile, an Italian picture naming test).

Consonant	Nasal			Plosive						Affricate				Fricative					Trill	Lateral	
	/m/	/n/	/ɲ/	/p/	/b/	/t/	/d/	/k/	/g/	/ts/	/dz/	/t∫/	/dʒ/	/f/	/v/	/s/	/z/	/∫/	/r/	/l/	/ʎ/
Position																					
Initial	+	+	−	+	−	+	−	−	−	−	−	+	−	−	−	−	−	−	−	−	−
Medial	+	+	−	+	−	+	−	−	−	−	−	+	−	−	−	−	−	−	−	+	−
Cluster	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−

Note: + consonant is present in the inventory; − consonant is absent from the inventory.

word-initial and in word-medial positions, when they were in the form of a single consonant. The lateral /l/ was correctly produced only in the word-medial position when it was in the form of a single consonant. He was not able to produce the nasal /ɲ/, the plosives /d/, /b/, /k/ and /g/, the affricates /ts/, /dz/, /dʒ/, the fricatives, the lateral /ʎ/ or the trill /r/. Therefore, in the word-initial position 16 of 21 (76%) consonants were missing; in the word-medial position 15 of 21 (71%) consonants were missing. He was not able to correctly produce consonant clusters.

4. Cognitive evaluation

At 48 months the boy received a cognitive assessment, using the Italian version of Wechsler Preschool and Primary Scale of Intelligence (Wechsler, 1973), that revealed borderline mental retardation (verbal intelligence quotient 65; performance intelligence quotient 80; full intelligence quotient 70), although linguistic difficulties and short attention span impaired the result of the test.

In view of the boy's difficulties in attention and language, we re-evaluated his cognitive skills at age 72 months. At this age, the child had started the rehabilitation treatment and his span attention was improved. We administered the Italian version of Comprehensive Test of Nonverbal Intelligence (Hammill, Pearson, & Wiederholt, 1998) using pantomime to measure his nonverbal reasoning abilities, independently of language skills. The test showed a nonverbal intelligence quotient of 90 (low average intelligence quotient).

The same clinical psychologist performed the two cognitive assessments.

5. Rehabilitation treatment

A comprehensive rehabilitation program, including cognition, fine motor training, behavioural strategies, language and speech was designed to improve patient functions. The rehabilitation program was carried out by a multidisciplinary team of professionals including child neuropsychiatrist, audiologist and phoniatrist, clinical psychologist, sociologist, speech and language therapist and neuropsychomotor therapist.

An initial evaluation was performed, using both standardized testing and informal observations and the parents' views were also presented. At this point the multidisciplinary team designed a comprehensive treatment plan which included speech and language therapy, psychomotor therapy, family and psychological counselling and psychoeducational intervention.

In the initial phase of treatment, the frequency was 4 individual speech and language therapy sessions and 2 individual psychomotor therapy sessions per week. Each therapy session was 45 min, with the last 15 min reserved for the clinician to discuss progress and ''homework'' with the parent.

The same group of professionals followed the boy through the rehabilitative intervention and held meetings every 3 months to discuss the patient's plan of care, the patient's progress, short- and long-term goals, and patient and family education needs. Follow-up evaluations took place every 6 months after the initial evaluation and were performed by the same team involved in the initial evaluation.

The rehabilitation program was based on holistic, sensible and dynamic principles.

Computerized cognitive programs were used to improve cognitive functions such as attention, memory, information processing, logical reasoning and problem solving. Moreover crumpling, drawing, scissoring, cubing, threading and plugging training were used to improve eye-hand coordination and fine motor functions.

Behavioural modification strategies were used to reduce hyperkinetic conduct and to improve attention span, mood control and personal and social functions.

In addition, language training programs including matching, naming, speech organization, event description, story telling and play were used to improve receptive and expressive language.

Furthermore, speech training programs such as auditory discrimination, phonological intervention, phonetic training, oral motor coordination and biofeedback were administered to improve speech intelligibility and articulation. We started with phonologic intervention because the child had a very incomplete consonant inventory and realized consonant substitutions systematically.

Lists of non-words were used to resolve the structure processes, particularly the consonant harmony. The work with non-words allow interrupting the child's incorrect habit of making the consonants assimilate in certain predictable ways within the word. We used lists of non-words with a plosive phoneme in the word-initial position and a fricative phoneme in the intervocalic position. We associated a picture character with each non-word, inducing the boy to repeat

and, successively, to name the non-words. These non-words were used initially as minimal pairs and then within picture stories.

At this point we improved the articulation of affricates and of trill /r/, using a phonetic training, and, finally, we worked on cluster reduction, always using the minimal pairs.

Simultaneously with phonologic and phonetic training, we used oral motor exercises to strengthen the oral muscles and improve their coordination.

At the beginning of primary school, the boy showed difficulties in learning involving especially writing and reading secondary to his speech and language impairment and behavioural problems. He was assigned an auxiliary teacher and followed an individual program during the first 2 years of primary school.

6. Results of rehabilitation treatment

Over the years, speech-language skills were assessed on several occasions using the TVL and PFLI. Assessments were performed by a qualified speech and language therapist who was not involved in treatment. As Tables 4 and 5

Table 4
Results of child's language assessments (Test TVL – Test di Valutazione del Linguaggio, a standardized test for Italian language assessment).

Child's chronological age (months)	Child's language age (months)					
	Receptive language	Sentence repetition	Naming	Phonological proprieties	Morphosyntactic proprieties	Sentence production
59	42–47	42–47	36–41	30–35	30–35	30–35
65	54–59	54–59	48–53	42–47	36–41	36–41
71	66–71	66–71	60–65	54–59	48–53	48–53
77			66–71	60–65	54–59	54–59
83				66–71	60–65	60–65
89					66–71	66–71

Note: according to TVL, when the language age is 66–71 months, the subtest is passed.

Table 5
Results of child's consonant inventories (Test PFLI – Prove per la valutazione Fonologica del Linguaggio Infantile, an Italian picture naming test).

	Child's chronological age (months)		
	60	72	84
Consonant			
/m/	+	+	+
/n/	+	+	+
/ɲ/	−	−	+
/p/	+	+	+
/b/	+	+	+
/t/	+	+	+
/d/	+	+	+
/k/	+	+	+
/g/	−	+	+
/ts/	−	−	+
/dz/	−	−	+
/tʃ/	+	+	+
/dʒ/	−	−	+
/f/	+	+	+
/v/	−	+	+
/s/	−	+	+
/z/	−	+	+
/ʃ/	−	−	+
/r/	−	−	+
/l/	+	+	+
/ʎ/	+	+	+

Note: + consonant is present in the inventory; − consonant is absent from the inventory.

reveal, the child demonstrated progressive increasing speech-language skills during the 4 years of rehabilitation treatment. At 71 months he showed adequate receptive language. In addition his expressive language progressively improved: the boy obtained speech that was adequately structured and intelligible. In fact, the phonologic and articulation disorders disappeared (84 months). He could speak in longer sentences (89 months), with an adequate vocabulary (77 months).

Improvement also was observed in tongue and palate movement (nasal emission disappeared), oral motor speed and coordination.

We also noted improvements in eye-hand coordination, fine motor functions, attention span, mood and hyperactivity control.

As child improved his functions, the frequency of therapy sessions was reduced accordingly, as long as he maintained and generalized improvements.

The child is now 8 years of age and is part of a normal class group. He has adequate linguistic abilities and follows the class program, showing no particular difficulties in learning.

7. Discussion

Floating-Harbor syndrome is a rare condition in which language delay has been a consistently reported feature. However, to our knowledge, no studies have provided a detailed description of the speech and language characteristics associated with the syndrome, nor the results of a long-term, multi-faceted speech-language intervention program. A review of the literature reveals only a few documented findings in terms of communication deficits, primarily a significant expressive language deficit (Ala-Mello & Peippo, 1996; Davalos et al., 1996; Fryns et al., 1996; Hersh et al., 1998; Houlston et al., 1994; Leisti et al., 1974; Patton et al., 1991; Pelletier & Feingold, 1973) and an improvement in communication capacities after speech and language therapy (Ala-Mello & Peippo, 2004; Feingold, 2006).

We report our findings on an Italian boy with FHS, with specific focus on his extensive communication deficits prior to intervention, and the changes we were able to bring about over a course of 48 months of a therapy program specifically tailored to his needs.

Many of his original problems were similar to what had been reported in previous cases (malocclusion, reduced speech motor control, and hypomobility of the palate) (Ala-Mello & Peippo, 1996, 2004; De Benedetto et al., 2004; Patton et al., 1991). However, although he exhibited some nasal air loss on high pressure consonants when we first evaluated him, he did not exhibit either hypernasal resonance nor an abnormal laryngeal voice quality. He did exhibit significant delays in phonologic knowledge and in the development of phonetic/phonemic production skills. He also displayed delayed eye-hand coordination and fine motor skills, motor instability, hyperkinetic conduct, poor attention and moodiness, all of which have been described in previous reports of individuals with this syndrome (Ala-Mello & Peippo, 2004; Feingold, 2006; Hersh et al., 1998; Rosen et al., 1998).

When we first encountered this boy, he presented with ‘‘borderline mental retardation’’, but his short attention span and receptive language deficits affected the results of tests intended to assess his intelligence. In fact, when we re-evaluated his cognitive skills at the age of 72 months with a nonverbal reasoning test using pantomime, he exhibited a nonverbal intelligence quotient of 90 (low average). At this age, he had started rehabilitation treatment and his attention span had improved.

We designed a multi-faceted treatment program that included cognitive, phonologic, and phonetic approaches as well as some work focused on improving basic oral motor skills. We are aware that there are no efficacy data on improving speech through ‘‘oral motor therapy’’, and that efforts to improve palatal function through such techniques also lacks scientific support (see Peterson-Falzone, Trost-Cardamone, Karnell, & Hardin-Jones, 2006; Peterson-Falzone, Hardin-Jones, & Karnell, 2009). However, our focus was on bringing this child’s attention to what his oral structures could do. We are also aware that children who exhibit delayed phonologic development may, among their other problems, still be learning the difference between sounds produced with an open velopharyngeal port (i.e., nasal consonants) and those produced with a closed port (normal stop-plosives, sibilants, etc.). Therefore, although some of the work with this child focused on oral motor skills, it is likely that his gradual improvement in phonologic knowledge eliminated the nasal emission found in his pre-treatment evaluation.

The changes that were brought about in this child are remarkable for two reasons: first, he initially presented with an array of developmental problems and poor communication skills that would have simply been relegated, in previous

decades, to the basket diagnosis of ''developmental delay''. Without specifically designed intervention, it is unlikely he would now be functioning at a normal class-room level for his chronological age, although in this case study we cannot ignore the issue of maturation as a factor in improvement, in addition to intervention. The lack of scientific control design and the length of the treatment period make it difficult to know how much can be attributed to treatment and how much to maturation. Second, this is a lesson that is not specific to Floating-Harbor syndrome or any other syndrome that poses threats to development. The lesson is that the developmental and communication problems we see in a child with either a well-known diagnosis or a relatively rare diagnosis are not necessarily impervious to therapy, and the child is not necessarily condemned to a lowered level of function in life.

Appendix A. Continuing education

1. The Floating-Harbor syndrome is a condition that results from:
   a. a chromosome deletion
   b. an autosomal dominant mutation
   c. an autosomal recessive mutation
   d. X-linked mutation
   e. the cause is presently unknown
2. From a clinical prospective, the Floating-Harbor syndrome is characterised by:
   a. abnormal craniofacial features, skeletal anomalies, severe mental retardation
   b. peculiar face, dermatoglyphic abnormalities, severe mental retardation
   c. specific facial features, postnatal growth retardation, delayed bone age, language delay
   d. prenatal growth retardation, microcephaly, speech absent
   e. prenatal growth retardation, congenital heart diseases, skeletal anomalies
3. The diagnosis of Floating-Harbor syndrome is based on:
   a. chromosomal examination
   b. mutation research
   c. magnetic resonance
   d. clinical triad of facial feature, short stature and language delay
   e. laboratory tests
4. A review of literature learns that in Floating-Harbor syndrome:
   a. language is usually absent
   b. expressive language is significantly delayed
   c. language is normal in most cases
   d. language starts to deteriorate after the age of 5 years
   e. language starts to deteriorate after puberty
5. The present case supports the view that:
   a. individual with Floating-Harbor never develop language
   b. Floating-Harbor is often associated with stuttering
   c. Floating-Harbor is often associated with aphonia
   d. Floating-Harbor is often associated with dysarthria
   e. Floating-Harbor is often associated with phonological and articulation disorders

References

Ala-Mello, S., & Peippo, M. (1996). Two more diagnostic signs in the Floating-Harbor syndrome. *Clinical Dysmorphology, 5*, 85–88.

Ala-Mello, S., & Peippo, M. (2004). The first Finnish patient with the Floating-Harbor syndrome: The follow-up of eight years. *American Journal of Medical Genetics A, 130*, 317–319.

Ball, M. J., Rahilly, J., & Tench, P. (1996). *The phonetic transcription of disordered speech*. San Diego: Singular Publishing Group.

Bastaki, L., El-Nabi, M. M., Azab, A. S., Gouda, S. A., Al-Wadaani, A. M., & Naguib, K. K. (2007). Floating-Harbor syndrome in a Kuwaiti patient: A case report and literature review. *Eastern Mediterranean Health Journal, 13*, 975–979.

Bortolini, U. (1995). *P.F.L.I. Prove per la valutazione fonologica del linguaggio infantile*. Padova: Edit Master.

Chudley, A. E., & Moroz, S. P. (1991). Floating-Harbor syndrome and celiac disease. *American Journal of Medical Genetics, 38*, 562–564.

Cianchetti, C., & Sannio Fancello, G. (1997). *TVL – Test di valutazione del linguaggio. Livello prescolare*. Trento: Edizioni Centro Studi Erickson.

Davalos, I. P., Figuera, L. E., Bobadilla, L., Martinez-Martinez, R., Matute, E., Partida, M. G., et al. (1996). Floating-Harbor syndrome. A neuropsychological approach. *Genetic Counseling, 7*, 283–288.

De Benedetto, M. S., Mendes, F. M., Hirata, S., Guaré, R. O., Haddad, A. S., & Ciamponi, A. L. (2004). Floating-Harbor syndrome: Case report and craniofacial phenotype characterization. *International Journal of Paediatric Dentistry, 14*, 208–213.

Feingold, M. (2006). Thirty-two year follow-up of the first patient reported with the Floating-Harbor syndrome. *American Journal of Medical Genetics A, 140*, 782–784.

Fryns, J. P., Kleczkowska, A., Timmermans, J., & van den Berghe, H. (1996). The Floating-Harbor syndrome: Two affected siblings in a family. *Clinical Genetics, 50*, 217–219.

Hammill, D. D., Pearson, N. A., & Wiederholt, J. L. (1998). *Test TINV. Test di intelligenza non verbale*. Trento: Edizioni Centro Studi Erickson.

Hersh, J. H., Groom, K. R., Yen, F. F., & Verdi, G. D. (1998). Changing phenotype in Floating-Harbor syndrome. *American Journal of Medical Genetics, 76*, 58–61.

Hirano, M. (1981). *Clinical examination of voice*. New York: Springer Verlag.

Houlston, R. S., Collins, A. L., Dennis, N. R., & Temple, I. K. (1994). Further observations on the Floating-Harbor syndrome. *Clinical Dysmorphology, 3*, 143–149.

International Phonetic Association. (1999). *Handbook of the international phonetic association. A guide to the use of the international phonetic alphabet*. Cambridge: Cambridge University Press.

Ioan, D. M., & Fryns, J. P. (2003). Floating-Harbor syndrome in two sisters: Autosomal recessive inheritance or germinal mosaicism? *Genetic Counseling, 14*, 431–433.

Lacombe, D., Patton, M. A., Elleau, C., & Battin, J. (1995). Floating-Harbor syndrome: Description of a further patient, review of the literature, and suggestion of autosomal dominant inheritance. *European Journal of Pediatrics, 154*, 658–661.

Lazebnik, N., McPherson, E., Rittmeyer, L. J., & Mulvihill, J. J. (1996). The Floating Harbor syndrome with cardiac septal defect. *American Journal of Medical Genetics, 66*, 300–302.

Leisti, J., Hollister, D. W., & Rimoin, D. L. (1974). Case report 2. In Bergsma, D. (Ed.). *Syndrome identification*. vol. 2 (pp.305).White Plains, NY: National Foundation-March of Dimes.

Leisti, J., Hollister, D. W., & Rimoin, D. L. (1975). The Floating-Harbor syndrome. *Birth Defects Original Article Series, 11*, 305.

Majewski, F., & Lenard, H.-G. (1991). The Floating-Harbor syndrome. *European Journal of Pediatrics, 150*, 250–252.

Patton, M. A., Hurst, J., Donnai, D., McKeown, C. M., Cole, T., & Goodship, J. (1991). Floating-Harbor syndrome. *Journal of Medical Genetics, 28*, 201–204.

Pelletier, G., & Feingold, M. (1973). Case report 1. In Bergsma, D. (Ed.). *Syndrome identification*. vol. 1 (pp.8–9). White Plains, NY: National Foundation-March of Dimes.

Penaloza, J. M., Garcia-Cruz, D., Davalos, I. P., Davalos, N. O., Garcia-Cruz, M. O., Perez-Rulfo, D., et al. (2003). A variant example of familial Floating-Harbor syndrome? *Genetic Counseling, 14*, 31–37.

Peterson-Falzone, S. J., Trost-Cardamone, J. E., Karnell, M. P., & Hardin-Jones, M. A. (2006). *The clinician's guide to treating cleft palate speech*. St. Louis, MO Mosby Elsevier.

Peterson-Falzone, S. J., Hardin-Jones, M. A., & Karnell, M. P. (2009). *Cleft palate speech* (4th ed.). St. Louis, MO Mosby Elsevier.

Robinson, P. L., Shohat, M., Winter, R. M., Conte, W. J., Gordon-Nesbitt, D., Feingold, M., et al. (1988). A unique association of short stature, dysmorphic features and speech impairment (Floating-Harbor syndrome). *Journal of Pediatrics, 113*, 703–706.

Rosen, A. C., Newby, R. F., Sauer, C. M., Lacey, T., Hammeke, T. A., & Lubinsky, M. S. (1998). A further report on a case of Floating-Harbor Syndrome in a mother and daughter. *Journal of Clinical and Experimental Neuropsychology, 20*, 483–495.

Tanner, J. M., & Whitehouse, R. H. (1976). Clinical longitudinal standards for height, weight, height velocity, weight velocity, and stages of puberty. *Archives of Disease in Childhood, 51*, 170–179.

Wechsler, D. (1973). *WPPSI – Scala d'intelligenza Weschler a livello prescolare e di scuola elementare*. Firenze: Giunti O S Organizzazioni Speciali.

Wiltshire, E., Wickremesekera, A., & Dixon, J. (2005). Floating-Harbor syndrome complicated by tethered cord: A new association and potential contribution from growth hormone therapy. *American Journal of Medical Genetics, 136*, 81–83.