Mouth breathing within a multidisciplinary approach: Perception of orthodontists in the city of Recife, Brazil

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Abstract

Objectives: To assess the knowledge of a mouth breathing pattern among orthodontists in the city of Recife, Brazil, and to examine their treatment protocols. Methods: In this cross-sectional study, members of the Orthodontics and Facial Orthopedics Association of Pernambuco responded individual structured interviews. A form with 14 questions, validated using the face value method, was used to collect data. The level of significance was set at 5%. Results: Of the 90 participants, 55.6% were women; 78.9% were specialists (the highest educational level); 67.8% worked full-time in private practice, and 38.9% were also professors. The most frequent diagnostic criteria were: Body posture (97.8%), lip competence (96.7%), and dark circles under the eyes (86.7%), with similar results among young and old orthodontists. The use of the Glatzel mirror was infrequent (3.3%). The most frequently mentioned mouth breathing sequelae were craniofacial (94.4%) and body posture (37.8%) changes. According to interviewees, mouth breathing duration (84.4%) was the item most often associated with sequelae. There were no significant associations between time since graduation and any of the factors under analysis. Most respondents, whether working in private clinics or in the public healthcare system, believed that mouth breathers should be treated by a multidisciplinary team. Conclusions: Most orthodontists, regardless of experience, have knowledge of the mouth breathing syndrome and understand the need of a multidisciplinary treatment.

Keywords: Mouth breathing. Orthodontics. Perception.
INTRODUCTION

Mouth breathing is a common respiratory disorder in childhood and one of the most serious public health problems. Its extended duration may lead to a series of structural and functional changes in the stomatognathic system and to physical, psychological and social effects. Mouth breathing problems and their complexity have been a matter of concern for health care workers in several specialties and have contributed to a more frequent adoption of multidisciplinary treatments and studies.

The mechanism of normal breathing consists of air inhaled through the nose and its flow through the pharynx and larynx to be humidified, warmed and filtered until the lungs, where the gas exchanges occur. As a vital and innate function of human beings, breathing should be performed in a physiologically correct way to protect upper airways and promote a satisfactory development of the craniofacial complex. If there is abnormal breathing, the organism undergoes a series of adaptive changes throughout the body, which may have serious consequences if not treated at an early stage, since it affects children during the development phase.

Mouth breathers are individuals that, for some organic, functional or neurological reason, develop an inadequate breathing pattern. They may be classified as: Organic insufficient nasal breathers, due to the presence of nasal, pharyngeal or mouth mechanical obstacles; functional insufficient nasal breathers, which are those that need to undergo surgery; and functional disabled mouth breathers, as sequelae of neurological disorders.

The most common implications of mouth breathing are changes in: Craniofacial and dental anatomy, orofacial structures related to speech, corporal and behavioral patterns, and oral functions. In dentistry, mouth breathing patients are diagnosed according to peculiar facial features, such as: Dark circles under the eyes, vacant eyes, short and incompetent upper lip, chapped lips, lip incompetence, hypotonic muscles, mandibular elevator muscle dysfunction, malocclusion, as well as swallowing, sucking and speaking disorders.

As mouth breathing treatments should be planned within a multidisciplinary philosophy, this study assessed the knowledge of the mouth breathing syndrome among orthodontists and orthopedists in the city of Recife, Brazil, and examined their diagnostic and treatment protocols.

METHODS

A quantitative cross-sectional survey was conducted with orthodontists who are members of the Pernambuco Society of Orthodontics and Facial Orthopedics, and worked in private practices or public healthcare services in the city of Recife, Brazil, since 2006. Only 18 out of 108 orthodontists were not found or refused to participate in the study. A total of 90 participants filled out a questionnaire with 15 questions about mouth breathing.

Informed consent was obtained from all clinicians who agreed to participate in this study. The answers were written down at the time of the interview to ensure its accuracy and reliability and to avoid recall problems. Answers reliability was tested using the face validation method with 10% of the interviewees. In this method, they were asked to explain, in their own words, what they have understood about each question. The interviews were conducted in their offices (private practice or healthcare service) and, whenever possible, there was an attempt to not interfere with the routine activities of the interviewees.

Univariate and bivariate analyses were used to obtain absolute distributions and percentages, and the following statistical measures were calculated: Mean, standard deviation, variation coefficient, minimum and maximum values of age (descriptive statistical techniques). A chi-square test was used for comparisons, or the Fisher’s exact test when the conditions to use the chi-square test were not met (inferential statistical techniques).
The level of significance was set at 5%. Data were stored in an Microsoft Office Excel spreadsheet, and the Statistical Analysis System v.8 (SAS) was used for statistical calculations. This study was approved by the Research Ethics Committee of the Pernambuco University, under #020/07.

RESULTS

Only 78.9% of the interviewees were specialists (the highest educational level), 67.8% worked full-time in their private practice, and 38.9% were also professors (Table 1).

Table 2 shows that there were no significant associations between time since graduation and any other variable under study (p>0.05). Most of the interviewees made the diagnosis of breathing pattern during anamnesis (70%). The most frequent diagnostic criteria were body posture (97.8%) and lip competence (96.7%), with similar percentages between groups regarding time since graduation; the use of the Glatzel mirror was infrequent and mentioned by only 9.4% of the interviewees graduated for the longest time.

The greatest percentage differences were found between orthodontists that chose “learning disability” (behavioral changes) as a sequel of mouth breathing (Table 3). Those with 11 to 20 years of graduation had a higher percentage than those with 21 or more years (37.9% x 12.5%).
Mouth breathing duration (84.4%) was the factor most often mentioned by interviewees as a cause of sequelae. There were no significant associations between time since graduation and any of the items under analysis, considering a level of significance of 5%.

All the 29 interviewees that worked in public healthcare services referred their patients to otolaryngologists and speech pathologists. Table 4 shows that the greatest percentage difference was found for those that refer to psychologists in the group with 21 or more years after graduation (7.7%) and those in the other two groups (37.5% each). For the clinicians that work in private practices, the greatest percentage difference was found in the group of those that refer patients to pediatricians, which was higher in the 11 to 22 years group than in the up to 10 years group. However, no significant association was found between time since graduation and the answers about referral by interviewees that worked in private practices and in public healthcare services.

Multidisciplinary treatment in cases of mouth breathing was classified as unimportant by two interviewees of the 21 or more years group, but this association was not significant (p>0.05) (Table 5).

### TABLE 2 - Evaluation of items associated with diagnosis according to years since graduation.

| Variable | Up to 10 years | 11 to 20 years | 21 years or more | Total Group | p value |
|----------|----------------|----------------|------------------|-------------|---------|
|          | n   | %  | n   | %  | n   | %  | n   | %  |          |
| When do you make the patient’s diagnosis? | | | | | | | |
| In the waiting room | 6 | 20.7 | 10 | 34.5 | 14 | 43.8 | 30 | 33.3 | $p^{(1)} = 0.160$ |
| During history taking | 22 | 75.9 | 21 | 72.4 | 20 | 62.5 | 63 | 70.0 | $p^{(1)} = 0.494$ |
| During examination | 4 | 13.8 | 10 | 34.5 | 9 | 28.1 | 23 | 25.6 | $p^{(1)} = 0.180$ |
| Which diagnostic methods are used to define the patient’s breathing pattern? | | | | | | | |
| Dental mirror | 15 | 51.7 | 16 | 55.2 | 20 | 62.5 | 51 | 56.7 | $p^{(1)} = 0.684$ |
| Metal plate | - | - | - | - | 3 | 9.4 | 3 | 3.3 | $p^{(1)} = 0.104$ |
| Water (3 minutes) | 5 | 17.2 | 4 | 13.8 | 4 | 12.5 | 13 | 14.4 | $p^{(1)} = 0.931$ |
| Water (1 to 2 minutes) | 8 | 27.6 | 5 | 17.2 | 11 | 34.4 | 24 | 26.7 | $p^{(1)} = 0.316$ |
| Spatula | 1 | 3.4 | 1 | 3.4 | 4 | 12.5 | 6 | 6.7 | $p^{(2)} = 0.360$ |
| Radiographs | 8 | 27.6 | 15 | 51.7 | 12 | 37.5 | 35 | 38.9 | $p^{(1)} = 0.166$ |
| Facial pattern | 24 | 82.8 | 25 | 86.2 | 23 | 71.9 | 72 | 80.0 | $p^{(1)} = 0.385$ |
| Body posture | 25 | 86.2 | 27 | 93.1 | 27 | 84.4 | 79 | 97.8 | $p^{(1)} = 0.615$ |
| Lip sealing | 28 | 96.6 | 29 | 100.0 | 30 | 93.8 | 87 | 96.7 | $p^{(2)} = 0.771$ |
| Type of occlusion | 21 | 72.4 | 23 | 79.3 | 23 | 71.9 | 67 | 74.4 | $p^{(1)} = 0.765$ |
| Swallowing | 18 | 62.1 | 18 | 62.1 | 20 | 62.5 | 56 | 62.2 | $p^{(1)} = 0.999$ |
| Dark circles under the eyes | 26 | 89.7 | 26 | 89.7 | 26 | 81.3 | 78 | 86.7 | $p^{(1)} = 0.582$ |
| TOTAL | 29 | 100.0 | 29 | 100.0 | 32 | 100.0 | 90 | 100.0 | |

(1): Chi-square test. (2): Fisher’s exact test.
TABLE 3 - Mouth breathing sequelae and their causes according to years since graduation.

| Variable | Time since graduation | p value |
|----------|-----------------------|---------|
|          | Up to 10 years | 11 to 20 years | 21 years or more | Total Group |
|          | n | % | n | % | n | % | n | % |
| Which factors determine sequelae of mouth breathing? | | | | | | | | |
| Patient age | 20 | 69.0 | 24 | 82.8 | 23 | 71.9 | 67 | 74.4 | p(1) = 0.444 |
| Etiologic factor | 20 | 69.0 | 24 | 82.8 | 26 | 81.3 | 70 | 77.8 | p(1) = 0.379 |
| Mouth breathing duration | 26 | 89.7 | 25 | 86.2 | 25 | 78.1 | 76 | 84.4 | p(1) = 0.508 |
| Other | 1 | 3.4 | - | - | - | - | 1 | 1.1 | p(2) = 0.644 |
| In your opinion, which sequelae are caused by mouth breathing? | | | | | | | | |
| A – Craniofacial and dental anomalies | | | | | | | | |
| Malocclusion | 28 | 96.6 | 29 | 100.0 | 28 | 87.5 | 85 | 94.4 | p(2) = 0.123 |
| Adenoid faces | 6 | 20.7 | 10 | 34.5 | 8 | 25.0 | 24 | 26.7 | p(2) = 0.477 |
| B – Anomalies of speech organs | | | | | | | | |
| Lip sealing | 7 | 24.1 | 9 | 31.0 | 10 | 31.3 | 26 | 28.9 | p(1) = 0.790 |
| Gingival enlargement | 1 | 3.4 | 6 | 20.7 | 3 | 9.4 | 10 | 11.1 | p(2) = 0.111 |
| Abnormal pattern of facial muscles | 2 | 6.9 | 6 | 20.7 | 7 | 21.9 | 15 | 16.7 | p(2) = 0.252 |
| C – Body anomalies | | | | | | | | |
| Changes in posture | 11 | 37.9 | 12 | 41.4 | 11 | 34.4 | 34 | 37.8 | p(1) = 0.853 |
| Dark circles under the eyes | 4 | 13.8 | 4 | 13.8 | 4 | 12.5 | 12 | 13.3 | p(2) = 1.000 |
| Respiratory deficiency | 9 | 31.0 | 5 | 17.2 | 7 | 21.9 | 21 | 23.3 | p(2) = 0.449 |
| D – Abnormal oral functions | | | | | | | | |
| Atypical swallowing | 10 | 34.5 | 11 | 37.9 | 9 | 28.1 | 30 | 33.3 | p(2) = 0.710 |
| Speech anomalies | 2 | 6.9 | 1 | 3.4 | - | - | 3 | 3.3 | p(2) = 0.305 |
| E – Behavioral anomalies | | | | | | | | |
| Learning disabilities | 8 | 27.6 | 11 | 37.9 | 4 | 12.5 | 23 | 25.6 | p(2) = 0.072 |
| Poor quality of life | 3 | 10.3 | 3 | 10.3 | - | - | 6 | 6.7 | p(2) = 0.135 |
| Physical tiredness | 2 | 6.9 | 2 | 6.9 | 2 | 6.3 | 6 | 6.7 | p(2) = 1.000 |
| Low self-esteem | 2 | 6.9 | 1 | 3.4 | - | - | 3 | 3.3 | p(2) = 0.305 |
| TOTAL | 29 | 100.0 | 29 | 100.0 | 32 | 100.0 | 90 | 100.0 |

(1): Pearson’s chi-square test. (2): Fisher’s exact test.
### TABLE 4 - Protocol to treat mouth breathers in public healthcare services and private practices according to years since graduation.

| Variables                          | Time since graduation | p value |
|------------------------------------|-----------------------|---------|
|                                    | Up to 10 years | 11 to 20 years | 21 years or more | Total Group |
|                                    | n      | %     | n      | %     | n      | %     | n      | %     |          |
| Public healthcare service - referrals |         |       |         |       |         |       |         |       |          |
| Otolaryngologist                   | 8      | 100.0 | 8      | 100.0 | 13     | 100.0 | 29     | 100.0 | **       |
| Speech pathologist                 | 8      | 100.0 | 8      | 100.0 | 13     | 100.0 | 29     | 100.0 | **       |
| Psychologist                       | 3      | 37.5  | 3      | 37.5  | 1      | 7.7   | 7      | 24.1  | p(1) = 0.221 |
| Dentist                            | 3      | 37.5  | 1      | 12.5  | 3      | 23.1  | 7      | 24.1  | p(2) = 0.851 |
| Pediatric psychiatrist             | 3      | 37.5  | 2      | 25.0  | 3      | 23.1  | 8      | 27.6  | p(1) = 0.889 |
| Orthodontist or orthopedist        | 7      | 87.5  | 7      | 87.5  | 12     | 92.3  | 26     | 89.7  | p(2) = 1.000 |
| TOTAL                              | 8      | 100   | 8      | 100.0 | 13     | 100.0 | 29     | 100.0 |          |
| Private practice - referrals       |         |       |         |       |         |       |         |       |          |
| Otolaryngologist                   | 27     | 93.1  | 29     | 100.0 | 30     | 93.8  | 86     | 95.6  | p(1) = 0.542 |
| Speech pathologist                 | 29     | 100.0 | 28     | 96.6  | 32     | 100.0 | 89     | 98.9  | p(1) = 0.644 |
| Psychologist                       | 4      | 13.8  | 6      | 20.7  | 4      | 12.5  | 14     | 15.6  | p(1) = 0.762 |
| Dentist                            | 6      | 20.7  | 7      | 24.1  | 8      | 25.0  | 21     | 23.3  | p(1) = 0.917 |
| Pediatric dentist                  | 4      | 13.8  | 10     | 34.5  | 7      | 21.9  | 21     | 23.3  | p(1) = 0.171 |
| Orthodontist or orthopedist        | 28     | 96.6  | 28     | 96.6  | 31     | 96.9  | 87     | 96.7  | p(1) = 1.000 |
| TOTAL                              | 29     | 100.0 | 29     | 100.0 | 32     | 100.0 | 90     | 100.0 |          |

(1): Fisher’s exact test. (2): Pearson’s chi-square test.

### TABLE 5 - Evaluation of answers to the question “What is your opinion about multidisciplinary treatment in cases of mouth breathing?” according to years since graduation.

| Opinion about multidisciplinary treatment | Time since graduation | p value |
|-------------------------------------------|-----------------------|---------|
|                                           | Up to 10 years | 11 to 20 years | 21 years or more | Total Group |
|                                           | n      | %     | n      | %     | n      | %     | n      | %     |          |
| Very important                            | 28     | 96.6  | 29     | 100.0 | 30     | 93.8  | 87     | 96.7  | p(1) = 0.284 |
| Important                                 | 1      | 3.4   | -      | -     | -      | -     | 1      | 1.1   |          |
| Not important                             | -      | -     | -      | -     | 2      | 6.3   | 2      | 2.2   |          |
| TOTAL                                     | 29     | 100.0 | 29     | 100.0 | 32     | 100.0 | 90     | 100.0 |          |

(1): Pearson’s chi-square test. (2): Fisher’s exact test.
DISCUSSION

Changes in breathing patterns may affect the general health of an individual1,9,15,16,18 and, therefore, are not limited to the occurrence of orthodontic disorders. For most dentists (70%), the breathing diagnosis is made according to anamnesis, which is taken when orthodontists, particularly those that graduated more recently (p<0.05), make an attempt to investigate other disorders associated with mouth breathing.27

In general, the selection of diagnostic clinical methods and criteria is directly associated with the objectives of the different healthcare specialties. One of the major problems in breathing diagnoses is the lack of an accurate definition of what a mouth breather is, as nasal breathing may occur in variable degrees.26,28

The main parameters to diagnose respiratory patterns were: Lip competence, body posture and dark circles under the eyes. The Glatzel mirror (3.3%), spatula (6.7%) and water in the mouth (14.4%) for 3 minutes (p<0.05) were diagnostic methods not often used by the interviewees (Table 2). These methods are frequently used to determine respiratory patterns and not to define causal factors. High percentages of participants mentioned the use of a dental mirror (56.7%) and radiographs (38.9%).

Mouth breathing is complex and compromises several organs and structures.10 Therefore, diagnoses should be made by the otolaryngologist (radiographs of the cavum and fiberoptic nasal endoscopy), orthodontist (lateral radiograph) and speech pathologist.11,13 Etiological factors should be carefully defined to avoid prescribing inadequate treatments.20,29 and other physical, emotional and social anomalies that affect health and life quality should be analyzed.15,16,21

The most frequent answers for the question about what factors contribute to the deterioration of mouth breathing were: Mouth breathing duration, etiological factor and age. The difference in time since graduation was not significant (p>0.05). Breast-feeding in the first months of life stimulates nasal breathing,23 and, in addition to responding to nutritional and emotional needs, ensures that infants develop facial and oral structures adequately and avoids that pacifier sucking, bottle feeding, finger sucking and nail biting become habits.6,14,29

Patients should be diagnosed and referred to specialists at an early stage, when facial bone deformations and cardiorespiratory, immunological and behavioral changes22,26 have not yet developed. In this study, 87 respondents (96.5%) considered that multidisciplinary treatment is essential, and only 2 (2.2%) of those graduated for a period longer than 21 years classified it as irrelevant, although differences were not significant (p>0.05) (Table 5).

The dentists unanimously agreed that mouth breathing leads to several sequelae, the most frequent of which are, according to literature: Long face,27 narrow nostrils, lip incompetence, lack of facial muscle tone,17,24 drooping eyes, dark circles under the eyes, slanted eyes, stooping shoulders, unbalanced spine and small nose. The factors most often mentioned were: Lip sealing (97.8%), body posture (96.7%) and dark circles under the eyes (86.7%), in agreement with findings reported in other studies.2,17,28

The most remarkable oral features were: Hypotonic, dry or everted lips, narrow and deep palate, lip incompetence, constrict maxillary arch, Class II malocclusions (facial asymmetry, open bite and posterior crossbite)24,26,29 and swallowing, sucking and speech abnormalities.4,13,22,23

The highest percentage of sequelae mentioned by the dentists was in the group of craniofacial and dental changes; malocclusion was pointed out by 94.4% of the participants, in agreement with data reported in other studies.13,21

Mouth breathers have frequent behavioral changes, such as: Irritation, bad mood, sleepiness, restlessness, lack of concentration, agitation, anxiety, fear, depression, suspiciousness,
impulsivity\textsuperscript{6,19} and learning disabilities.\textsuperscript{20,30} These data confirm the opinion of the interviewees, as well as other authors belief:\textsuperscript{1,7} Prevention and early diagnosis of mouth breathing are important to reduce problems in psychosocial adjustment.

Most dentists mentioned that mouth breathers are special patients who present a series of problems and sequelae, and need to be treated differently by using an interdisciplinary approach within a broad view of multidisciplinarity (Tables 4 and 5). This may be justified by the emphasis assigned to this problem in recent years and by the recognition that integrated approaches are important to improve life quality.\textsuperscript{16,21} However, the difficulty to access public services and the fact that the general population is unaware of the sequelae caused by this disorder may affect the results.

**CONCLUSIONS**

» A high percentage of dentists have knowledge about the mouth breathing syndrome and its sequelae.

» According to most orthodontists and orthopedists interviewed, a multidisciplinary treatment is essential for full rehabilitation.

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