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## SYSTEMATIC REVIEW

### Postural disorders in mouth breathing children: a systematic review

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#### KEYWORDS

Mouth breathing syndrome;  
Oral breathing;  
Children;  
Posture;  
Photography;  
Kinematics

#### Abstract

**Background:** Mouth breathing syndrome can cause sleep disturbances that compromise the performance of children in school. It might also cause postural abnormalities involving the head and cervical spine; however, the association between postural abnormalities and mouth breathing in children is unclear.

**Objective:** To assess the methodological quality of studies and determine if there is an association between mouth breathing and postural disorders in children.

**Methods:** Databases comprised MEDLINE, CINAHL, PEDro, LILACS, EMBASE and Cochrane Central Registrar of Controlled Trials. Searches were until March 2016 and included studies that evaluated postural disorders in children diagnosed with mouth breathing. The Downs and Black checklist was used to evaluate the quality of the evidences.

**Results:** Ten studies were included totaling 417 children from 5 to 14 years. Two studies used the New York State Postural Rating Scale, seven used photography and one used motion capture to measure posture. The methods used to analyze the data included the Postural Analysis Software (SAPO), Fisiometer, ALCimagem and routines in MATLAB program. Quality assessment resulted in low scores (<14) for all the studies. The main areas of weakness were a clear description of the participants, of the methods used to access posture, of the principal confounders and

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33 lack of power analysis. External and internal validity were also threatened by the lack of a  
34 representative sample and blinding of the participants and assessors, respectively.

35 *Conclusions:* The review provides low evidence that mouth-breathing pattern in children  
36 between the ages 5–14 years is associated with postural deviations.

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## 39 Introduction

40 The mouth-breathing syndrome (MBS) is a clinical condi-  
41 tion among school-aged children characterized by mixed or  
42 mouth supplementary breathing that replaces an exclusively  
43 nasal breathing pattern.<sup>1</sup> MBS is associated with disorders  
44 of the speech organs and is generally combined with facial  
45 deformities, with the potential to progress to cardiorespi-  
46 ratory, endocrine diseases and sleep disturbances that can  
47 compromise the behavior and performance of the children  
48 in school.<sup>2</sup> Furthermore, this syndrome has been related to  
49 genetic factors, unhealthy oral habits and nasal obstructions  
50 of varying degrees of severity and duration and has also been  
51 associated with pediatric allergy-related otorhinolaryngol-  
52 ogy complaints.<sup>2</sup>

53 Studies have also correlated this condition with postu-  
54 ral abnormalities<sup>3,4</sup> and suggested that the obstruction or  
55 narrowing of the pharyngeal air space would lead to for-  
56 ward head projection to improve the airflow trajectory  
57 to the lower respiratory tract, causing further postural  
58 adaptations.<sup>5,6</sup> With altered and sustained head positions,  
59 adaptations in the scalene, sternocleidomastoid and upper  
60 trapezius muscles might occur, which are normally asso-  
61 ciated with overuse in response to the nasal obstruction  
62 necessary to facilitate oral inspiration.<sup>7</sup> Despite reports  
63 that MBS can cause postural abnormalities,<sup>6,8,9</sup> the asso-  
64 ciation between postural deviations and MBS is unclear.  
65 Some studies have shown that children with mouth breath-  
66 ing present changes in the posture of the head and cervical  
67 spine; however, other studies were unable to support such  
68 relationships.<sup>4,10,11</sup>

69 In addition, different tools have been used to evalu-  
70 ate posture in mouth breathing children that vary from a  
71 simple observational chart posture, to photographic anal-  
72 ysis or to advanced motion capture systems that used  
73 passive markers attached to the segments to determine  
74 body angles and distances.<sup>3,4,10,12</sup> Different methods and  
75 marker positioning may lead to discrepancies between  
76 study findings. Moreover, forward head position has been  
77 described in most studies, however changes in postural  
78 alignment beyond the head and neck have also been con-  
79 sidered in some studies,<sup>13,14</sup> which can provide insights  
80 on the effects of MBS on the whole body postural align-  
81 ment. For physical therapists, providing information on  
82 the association between mouth-breathing condition and  
83 postural changes in children is important for clinical  
84 decision-making, and this information is lacking on the  
85 literature.

86 Thus, we carried out a systematic review to assess the  
87 methodological quality of studies that evaluated postural  
88 disorders in children with mouth breathing and determine  
89 if there is an association between mouth breathing and  
90 postural disorders. The information from this review could  
91 help the development of rehabilitation programs focused on  
92 helping these children.

## 93 Methods

### 94 Search strategy

95 The following electronic databases were searched: MED-  
96 LINE, Cumulative Index to Nursing and Allied Health  
97 Literature (CINAHL), Physiotherapy Evidence Database  
98 (PEDro), LILACS database (Literatura Latino-Americana e  
99 do Caribe em Ciências da Saúde) and Excerpta Medica  
100 Database (EMBASE), including Cochrane Central Registrar  
101 of Controlled Trials. Randomized and non-randomized con-  
102 trolled trials were included in the review. Searches were  
103 performed by one of the authors (PN) and the strategy is  
104 described in details on [Appendix 1](#). The search results were  
105 limited to studies in children (<18 years), reported in English  
106 or Portuguese and include all published studies until March  
107 2016.

### 108 Study selection

109 Two authors (PN and PM) independently reviewed the titles  
110 and abstracts retrieved from all databases and determined  
111 if the studies met the inclusion criteria. A third author  
112 (SM) decided on any disagreement. Studies were included if  
113 reported participants with mouth breathing and at least one  
114 element of postural assessment obtained with photographs,  
115 or by a software program or even a postural observational  
116 analysis that considered either the head, neck, shoulder,  
117 scapula, spine, pelvis, knee and/or foot. Inclusion criteria  
118 for mouth breathing children were based on clinical evalua-  
119 tion and video laryngoscopy. Signs and symptoms included  
120 the absence of active lip seal, facial features, presence of  
121 deleterious oral habits, breathing pattern during the day  
122 and overnight, tongue tonus, associated allergies and dif-  
123 ficulty concentrating in school. Studies were excluded if  
124 reported the use of X-rays due to its invasiveness, presence  
125 of associated syndromes, or if the assessment protocol was  
126 not described. Due to the limited literature in this area all  
127 studies designs were included.

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