UNIVERSIDADE FEDERAL FLUMINENSE

FACULDADE DE ODONTOLOGIA

PADRÃO RESPIRATÓRIO E DIREÇÃO DE CRESCIMENTO FACIAL – UMA REVISÃO SISTEMÁTICA

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PADRÃO RESPIRATÓRIO E DIREÇÃO DE CRESCIMENTO FACIAL – UMA REVISÃO SISTEMÁTICA

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Dissertação apresentada à Faculdade de Odontologia da Universidade Federal Fluminense, como parte dos requisitos para obtenção do título de Mestre, pelo Programa de Pós-Graduação em Odontologia.

Área de Concentração: Ortodontia

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Co-orientadora: Prof[a]. Dra. Cláudia Trindade Mattos

Niterói

2015

FICHA CATALOGRÁFICA

N244 Nascimento, Rizomar Ramos do.

Padrão respiratório e direção de crescimento facial – Uma revisão sistemática / Rizomar Ramos do Nascimento;
orientador: Oswaldo de Vasconcellos Vilella, co-orientadora: Cláudia Trindade Mattos. - Niterói: [s.n.], 2015.

32 f.
Inclui tabelas.
Dissertação (Mestrado em Ortodontia) – Universidade Federal Fluminense, 2015.
Bibliografia: f. 25-28 .

1. Respiração bucal. 2. Crescimento facial. 3. Cefalometria.
I. Vilella, Oswaldo de Vasconcellos [orien.]. II. Mattos, Cláudia Trindade [co-orien.]. III. Título.

CDD 617.643

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AGRADECIMENTOS

Primeiramente, ao Deus Criador, que me deu a vida e capacidade de discernimento.

À minha esposa, Flavia, por todo a sua leveza, alegria e companheirismo, e por ser o amor da minha vida.

Aos meus pais, Horizomar e Janete (*in memoriam*), por me apresentarem o caminho mais difícil: o da sinceridade, paciência e dedicação. O melhor caminho.

Ao Dr. Oswaldo de Vasconcellos Vilella, pela orientação segura na condução deste trabalho, mas especialmente, pela maneira ética que conduz todos os assuntos, transmitindo segurança aos seus orientados e aos amigos.

À Dra. Cláudia Trindade Mattos, pela orientação fundamental na elaboração deste trabalho, pela leveza e segurança com que tem passado seu conhecimento, e pela prontidão nos momentos em que precisei de sua ajuda.

À Dra. Beatriz de Souza Vilella, pela alegria, tranquilidade e disposição em ajudar, constantes durante todo o curso.

Ao Dr. José Nelson Mucha, pela sempre inovadora maneira de transmitir seus conhecimentos, e pelo interesse e dedicação em nosso aprimoramento didático e profissional.

À Dra. Adriana de Alcântara Cury Saramago, pela dedicação, delicadeza e forma atenciosa com que atua constantemente em todos as atividades do ensino

Ao Dr. Alexandre Trindade Simões da Motta, pela forma competente e eficiente com que ensina, aliados à atenção à nossa formação profissional.

À Danielle Masterson Ferreira, bibliotecária da UFRJ, pela orientação precisa e decisiva para as buscas eletrônicas realizadas na elaboração deste trabalho.

Aos meus colegas de turma, Letícia, Luiza, Thaís, Giordani, Henry, Marlon e Ricardo, pelos ótimos momentos, e pela troca de conhecimento e incentivo profissional que espero que continuem a existir.

Aos amigos Cinthia, Ilana, Jamile, Lillían, Natália e Johnny, pela jovialidade que manteve o ambiente sempre alegre.

A todos os funcionários, em especial à D. Elizete, pelos momentos de descontração, e pelo apoio constante.

RESUMO

Nascimento RN. Padrão respiratório e direção de crescimento facial – uma revisão sistemática. [dissertação]. Niterói: Universidade Federal Fluminense, Faculdade de Odontologia; 2015.

Número de registro CRD 42013005707 – Centre for Reviews and Dissemination, University of York, UK (crd-register@york.ac.uk).

Objetivo: Através da revisão sistemática da literatura, investigar a possível associação entre a direção do crescimento facial e o padrão respiratório. **Metodologia**: Extensa pesquisa bibliográfica foi realizada nas bases de dados eletrônicas PubMed, Scopus, Web of Science, The Cochrane Library e Lilacs, buscando estudos longitudinais que acompanhassem o crescimento facial de indivíduos respiradores bucais e nasais, com desenho prospectivo ou retrospectivo. Foram incluídos estudos randomizados controlados, estudos de caso e controle, e estudos coorte. Os componentes da amostra deveriam ter sido acompanhados por um período igual ou superior a um ano, através de mensurações realizadas sobre imagens radiológicas ou tomografias. **Resultados**: Cinco estudos longitudinais, sendo dois prospectivos e três retrospectivos, não randomizados, foram incluídos na presente revisão. O tempo de acompanhamento variou de 28 a 60 meses. Diferenças significantes nas variáveis utilizadas para avaliação do crescimento mandibular e altura facial anterior foram verificadas entre os grupos controle e experimental, no início e no final do acompanhamento. Os estudos apresentaram moderado risco de viés. Entretanto, avaliaram variáveis distintas, impossibilitando comparações para realização da meta-análise. **Conclusões:** Existem evidências de que, quando o padrão respiratório muda de bucal para nasal nos indivíduos em crescimento**,** a direção de crescimento mandibular torna-se mais horizontal. A altura facial anterior pode não apresentar alterações significativas, ou diminuir em decorrência do crescimento mais horizontal da mandíbula.

Palavras-chave: respiração bucal, crescimento facial, cefalometria.

ABSTRACT

Nascimento RN.The breathing pattern and facial growth direction – a systematic review. [dissertation]. Niterói: Federal Fluminense University, School of Dentistry; 2015.

Register number CRD 42013005707 – Centre for Reviews and Dissemination, University of York, UK (crd-register@york.ac.uk).

Aim: The aim of this study was to assess, conducting a systematic review of the literature, the prognosis for the mandibular growth direction and anterior facial height in subjects that change from oral to nasal breathing. **Methodology**: An extensive bibliographical research was held in the electronic databases PubMed, Scopus, Web of Science, The Cochrane Library and LILACS, searching for longitudinal studies presenting prospective or retrospective design. Controlled trials, case-control studies and cohort studies were included. The components of the sample had to be accompanied by a period equal to or greater than one year, through measurements performed on radiological images or computed tomography. **Results**: Five longitudinal studies, two prospective and three retrospective, non-randomized, were included in this review. The follow-up time ranged from 28 to 60 months. Significant differences in the variables used for evaluation of mandibular growth and anterior facial height were accessed between the experimental and control groups at the beginning and end of follow-up. The studies presented a moderate risk of bias. However, as different variables were evaluated, it was impossible to carry out a meta-analysis. **Conclusions**: There is evidence to support that, when the breathing pattern switches from oral to nasal in developing individuals, the mandibular growth direction becomes more horizontal. The anterior facial height may not show significant changes, or it decreases as a result of more horizontal mandibular growth.

Keywords: mouth breathing, facial growth, cephalometritcs

1. INTRODUÇÃO

Há pelo menos um século tem sido discutida a relação entre o padrão respiratório e seus efeitos no crescimento facial, bem como sua relevância para os resultados do tratamento ortodôntico. As necessidades respiratórias são fatores determinantes na postura da cabeça e da língua. Ao se estabelecer um padrão respiratório alterado, o posicionamento dessas estruturas pode gerar mudanças no equilíbrio entre dentes, ossos e tecidos moles faciais, afetando tanto o crescimento dos ossos maxilares, como o posicionamento dos dentes.[1-4] Alguns estudos sugerem que a respiração bucal habitual na infância, associada à obstrução nasal, pode levar a deformidades faciais em maior ou menor grau.[5-7]

Uma típica expressão facial, a face adenoideana, tem sido relacionada a indivíduos diagnosticados como portadores de respiração bucal. Nesses casos, pode ser observada uma relação alterada entre mandíbula e maxila, com aumento da altura facial anterior e da inclinação do plano mandibular, refletindo um predominante padrão de crescimento vertical da face. Alterações intraorais acompanham o quadro facial, com protrusão de incisivos superiores, abóbada palatina alta, e arcada superior estreita e em forma de 'V'.[8]

Por volta dos 4 anos de idade, o esqueleto craniofacial atinge 60% de seu tamanho adulto.[1] O estabelecimento de um padrão respiratório correto pode desempenhar papel importante na prevenção de um padrão de crescimento craniofacial indesejável, como a síndrome de face longa ou da face adenoideana.[1,9,10]

Segundo alguns autores, porém, a relação entre respiração, postura alterada e o desenvolvimento de desarmonias de crescimento não tem se mostrado tão clara.[11-14] Tais pesquisadores afirmam que tem se estabelecido somente partes desta relação, e que mais evidências devem ser reunidas antes de se preconizar intervenções.[5,15]

Outros estudos apontaram para a necessidade de pesquisas longitudinais envolvendo um maior número de indivíduos, relacionando o padrão respiratório às variáveis do crescimento facial, como a única forma de

estabelecer a relação causa-efeito entre o padrão respiratório e o desenvolvimento dos ossos maxilares.[7,16,17]

Considerando-se tais controvérsias, a presente revisão sistemática foi conduzida com o objetivo de pesquisar o prognóstico para a direção do crescimento mandibular e altura facial anterior em indivíduos que alteraram o padrão respiratório de oral para nasal. Foram reunidos estudos longitudinais controlados, que mensuraram estas duas variáveis em grupos controle de respiradores nasais, e em grupos experimentais de respiradores bucais, comparando-se medições antes e depois da mudança do padrão respiratório.

2. METODOLOGIA

Os critérios de inclusão e métodos de análise foram especificados previamente, e documentados em protocolo no Centre for Reviews and Dissemination, University of York, UK (crd-register@york.ac.uk), sob o número de registro CRD 42013005707, com a seguinte pergunta foco: qual o prognóstico para a direção de crescimento mandibular e para a altura facial anterior em indivíduos respiradores bucais que normalizaram o padrão respiratório?

O formato para esta revisão foi baseado nas diretrizes do *Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement.*[18] A primeira fase envolveu a formulação da hipótese nula, e de uma pergunta para a pesquisa. A Tabela 1 descreve o formato PI/ECO[19] (População; Intervenção/Exposição; Comparação; Outcomes - Resultados esperados), a hipótese nula e a pergunta.

Na fase de busca de artigos não foram feitas restrições quanto ao ano de publicação ou ao idioma dos estudos. Foram adotados os seguintes critérios de inclusão para a seleção de trabalhos: estudos controlados, estudos longitudinais prospectivos ou retrospectivos, estudos de caso e controle e estudos coorte, envolvendo indivíduos respiradores bucais que modificaram seu padrão para respiração nasal. Os trabalhos deveriam avaliar a direção do crescimento facial, através da medição de possíveis alterações nas dimensões da altura facial anterior e na direção do crescimento mandibular, através de análises cefalométricas em telerradiografias de perfil ou tomografia

computadorizada, com acompanhamento de, no mínimo, um ano. Os critérios de exclusão foram: estudos laboratoriais, estudos em animais, séries de casos, relatos de casos, revisões narrativas, opiniões de autor; estudos que envolveram pacientes submetidos a tratamento ortodôntico ou cirurgia ortognática, pacientes portadores de síndromes, fendas palatais e labiais.

Sob a orientação de uma bibliotecária com experiência na elaboração de pesquisas na área de saúde (DMF), um mapeamento conceitual prévio identificou os descritores de saúde referentes ao tema (Tabela 2). Utilizando-se estes descritores, estratégias de busca foram elaboradas, de acordo com o tutorial de cada base eletrônica, gerando um protocolo específico de busca para cada uma das seguintes bases: PubMed, Web of Science, Scopus, The Cochrane Library e LILACS. Adicionalmente, foram feitas pesquisas nas referências dos artigos obtidos, em busca de trabalhos não identificados nas bases eletrônicas, além de contatos com especialistas, na tentativa de identificar trabalhos potencialmente relevantes, publicados e não publicados.

Tabela 1. Formato PI/ECO, hipótese nula e pergunta.

P – População	Respiradores bucais que alteraram o padrão respiratório de bucal para nasal.
I / **E** – Intervenção / Exposição	Indivíduos submetidos a adenoidectomia, tonsilectomia, adenotonsilectomia, ou correção cirúrgica de estenose nasal durante a fase de crescimento para restabelecer o padrão respiratório nasal.
C – Comparação	Do crescimento facial em pacientes que normalizaram seu padrão respiratório em relação ao de indivíduos não tratados respiradores nasais.
O – *Outcomes* – Resultados esperados	Avaliação de, pelo menos, uma das seguintes variáveis cefalométricas, antes e após o estabelecimento da respiração nasal: 1) altura facial anterior; 2) inclinação do plano mandibular em relação à base do crânio.
Hipótese nula	O padrão respiratório não influencia a direção de crescimento facial e a altura facial anterior.
Pergunta	Qual o prognóstico para a direção de crescimento mandibular ou para a altura facial anterior em indivíduos respiradores bucais que normalizaram o padrão respiratório?

Em uma seleção inicial, o primeiro autor (RRN), utilizando o método descrito, identificou os estudos relacionados ao tema, procedendo à análise dos títulos e resumos. Os estudos repetidos foram excluídos. Uma avaliação adicional excluiu os estudos que não preencheram os critérios em sua totalidade. Os artigos que preencheram todos os critérios foram obtidos na íntegra. Dois autores (RRN e OVV) fizeram a leitura e revisão integral dos textos selecionados. Conflitos interexaminadores foram resolvidos por um terceiro autor (CTM) em uma reunião de consenso.

Os principais resultados avaliados foram: 1. Diferenças entre as medições iniciais (T1) e finais (T2) em inclinações do plano mandibular em relação à linha SN, e altura facial anterior (total, superior, inferior e proporções entre estas medições); e 2. A relação entre mudanças nestas variáveis e a normalização do padrão respiratório.

Tabela 2. Descritores utilizados para buscas nas diferentes bases de dados.

	Descritores
Grupo 1	(head[MeSH Terms] OR head[tiab] OR “head posture”[tiab] OR "maxillofacial development"[MeSH Terms] OR "maxillofacial development"[tiab] OR face[tiab] OR “facial growth”[tiab] OR “facial development”[tiab] OR “facial pattern”[tiab] OR “facial patterns”[tiab] OR “facial morphology”[tiab] OR “craniofacial growth”[tiab] OR “facial growth direction”[tiab] OR "vertical dimension"[MeSH Terms] OR "vertical dimension"[tiab] OR “lower face height”[tiab] OR “dentition”[MeSh Terms] OR “dentition”[tiab] OR "dental occlusion"[MeSH Terms] OR "dental occlusion"[tiab] OR "malocclusion"[MeSH Terms] OR "malocclusion"[tiab] OR “mandible”[MeSH Terms] OR “mandible”[tiab] OR chin[MeSH Terms] OR chin[tiab] OR “maxilla”[MeSH Terms] OR “maxilla”[tiab] OR “jaw”[MeSH Terms] OR “jaw”[tiab])
Grupo 2	("respiration"[MeSH Terms] OR “respiration”[tiab] OR "mouth breathing"[MeSH Terms] OR “mouth breathing”[tiab] OR respiratory mechanics[tiab] OR respiratory pattern[tiab] OR respiratory patterns[tiab] OR oral breathing[tiab] OR oral breathers[tiab] OR buccal breathing[tiab] OR buccal breathers[tiab] OR mouth respiration[tiab] OR mouth breather[tiab] OR upper airways[tiab] OR "nasopharynx"[MeSH Terms] OR nasopharynx[tiab] OR nasal airflow[tiab] OR nasopharyngeal airways[tiab] OR “adenoids”[MeSH] OR adenoids[tiab])
Grupo 3	(“cephalometry”[Mesh Terms] OR cephalometry[tiab] OR “teleradiology”[Mesh Terms] OR teleradiology[tiab] OR radiographic analysis[tiab] OR “lateral cephalogram” [tiab] OR “lateral cephalograms”[tiab] OR “lateral radiographs”[tiab] OR “cone-beam computed tomography”[Mesh Terms] OR “cone-beam computed tomography”[tiab] OR “cone beam CT”[tiab] OR “cone beam”[tiab] OR “computerized tomography”[tiab]

A última pesquisa nas bases de dados foi realizada em novembro de 2014, sendo atualizada mensalmente para PubMed e Web of Science até março de 2015. As estratégias de buscas para cada base eletrônica podem ser vistas na Tabela 7 (Anexos).

Artigos que preencheram os critérios de inclusão foram avaliados quanto à qualificação metodológica. Devido às suas características, os estudos foram avaliados de acordo com o *Methodological Index for Non-Randomized Studies (MINORS),*[20] um checklist desenvolvido para avaliar estudos clínicos não randomizados (Tabela 3).

Tabela 3. Avaliação da qualificação metodológica – baseada no MINORS.

Itens avaliados		**Pontuação***
1	Objetivo claramente definido	
2	Inclusão de pacientes consecutivos**	
3	Coleta prospectiva dos dados	
4	Desfechos de acordo com o objetivo do estudo	
5	Avaliação imparcial dos resultados	
6	Período de acompanhamento apropriado ao objetivo do estudo	
7	Perda menor que 5% no período de acompanhamento	
8	Cálculo prospectivo do tamanho do estudo	
9	Grupo controle adequado	
10	Grupos controle e experimental contemporâneos	
11	Equivalência dos grupos no início do estudo	
12	Análise estatística adequada	

* Pontuação: 0 (não relatado), 1 (relatado mas não adequado), ou 2 (relatado e adequado).
**Satisfazendo os critérios de inclusão

3. ARTIGOS PRODUZIDOS

Mandibular growth direction and anterior facial height: prognosis for individuals that change from oral to nasal breathing – a systematic review

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Abstract: The aim of this study was to assess, conducting a systematic review of the literature, the prognosis for the mandibular growth direction and anterior facial height in subjects that change from oral to nasal breathing. An extensive bibliographical research was held in the electronic databases PubMed, Scopus, Web of Science, The Cochrane Library and Lilacs, searching for longitudinal studies presenting prospective or retrospective design. Controlled trials, case-control studies and cohort studies were included. The components of the sample had to be accompanied by a period equal to or greater than one year, through measurements performed on radiological images or computed tomography. Five longitudinal studies, two prospective and three retrospective, non-randomized, were included in this review. The follow-up time ranged from 28 to 60 months. Significant differences in the variables used for evaluation of

mandibular growth and anterior facial height were accessed between the experimental and control groups at the beginning and end of follow-up. The studies presented a moderate risk of bias. However, as different variables were evaluated, it was impossible to carry out a meta-analysis. There is evidence to support that, when the breathing pattern switches from oral to nasal in developing individuals, the mandibular growth direction becomes more horizontal. The anterior facial height may not show significant changes, or it decreases as a result of more horizontal mandibular growth.

Keywords: mouth breathing, facial growth, cephalometrics.

INTRODUCTION

For at least a hundred years, the relationship between breathing patterns and facial growth has been discussed. Respiratory needs are determining factors in the posture of the head and tongue. By establishing an altered breathing pattern, the position of these structures can generate changes in the balance between teeth, bones and facial soft tissues, affecting both the growth of the jaws, and the positioning of teeth.[1-4] Some studies suggest that the usual oral breathing in childhood, associated with nasal obstruction, may lead to facial deformities, to a greater or lesser degree.[5-7]

A typical facial expression, the adenoid face, has been related to individuals diagnosed as oral-breathing patients. In these cases, an altered relationship can be observed between the maxilla and mandible, due to an increase in the anterior facial height and the mandibular plane inclination, reflecting a vertical facial growing pattern. Intraoral changes accompany the facial feature, with upper incisor protrusion, narrow upper arch in a ‘V’ shape, high palate, and changed relationship between mandible and maxilla.[8]

By four years old, the craniofacial skeleton reaches 60% of its adult size.[1] The establishment of a correct mode of breathing may play an important role in preventing an unwanted facial growth pattern, such as the long-face syndrome, or adenoid face.[1,9,10]

According to some authors, however, the relationship between breathing, altered posture and the development of growth disharmonies have not been so clearly stated.[11-14] These researchers state that only parts of this relationship have been established, and more evidence must be gathered before recommending intervention.[5,15]

Other studies have pointed out the need for longitudinal studies, involving a larger number of individuals, relating changes in breathing pattern to changes in facial growth, as the only way to establish the cause-effect relationship between the breathing pattern and the development of the jaws.[7,16,17]

Considering such controversies, this systematic review was performed with the aim of searching for the prognosis for the mandibular growth direction (MGD) and anterior facial height (AFH) in individuals who have changed their respiratory patterns from oral to nasal.

Methodology

The inclusion criteria and methods of analysis were previously specified, and documented in a protocol in The Centre for Reviews and Dissemination, University of York, UK (crd-register@york.ac.uk), under the registration number CRD 42013005707, with the following question: what is the prognosis for the mandibular growth direction and anterior facial height in individuals that have changed from oral to nasal breathing?

The format for this review was based on the guidelines of the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement.*[18] The first phase involved the formulation of a question for research, and the null hypothesis. Table 1 describes the PI/ECO format[19] (Population, Intervention / Exposure, Comparison, Outcomes) used in this phase, the null hypothesis, and the question.

An experienced librarian in the health research area (DMF), helped to develop a prior conceptual mapping, identifying descriptors related to the topic (Table 2). Search strategies were developed using these descriptors in accordance with the tutorial generating a specific protocol for each electronic database: PubMed, Web of Science, Scopus, The Cochrane Library and

LILACS. Additionally, the references of the articles obtained were screened, in order to identify works that were not found in the electronic databases. Experts were contacted in an attempt to identify potentially relevant studies, published and unpublished.

No restrictions were made to publication year or language of the studies. The following inclusion criteria were adopted to select works: randomized or non-randomized controlled trials, prospective or retrospective longitudinal studies, case-control studies, cohort studies; mouth-breathing patients who had modified their respiratory pattern from oral to nasal breathing; evaluation of the facial growth direction using images of cephalometric radiographs or computed tomography; follow-up equal to or higher than one year. Exclusion criteria were: laboratory studies, animal studies, case series, case reports, narrative reviews, author's opinions; patients undergoing orthodontic treatment or orthognathic surgery, patients with syndromes, palate and cleft lip.

Table 1. PI/ECO format, question and null hypothesis.

P – Population	Oral breathers who altered their oral breathing pattern for nasal breathing.
I/E – Intervention / Exposure	Individuals that underwent adenoidectomy, tonsillectomy, adenotonsillectomy, or surgical correction of nasal stenosis during growth to restore nasal breathing.
C – Comparison	Of the facial growth in patients who normalized their breathing pattern compared to the facial growth in untreated nasal-breather subjects.
O – Outcomes	Evaluation of, at least, one of the following cephalometric variables, before and after the establishment of nasal breathing: 1) anterior facial height; 2) mandibular plane inclination in relation to the cranial base.
Null hypothesis	The breathing pattern does not influence the facial growth direction or anterior facial height.
Question	What is the prognosis for the mandibular growth direction and anterior facial height in subjects that have changed from oral to nasal breathing?

An initial selection was performed by the first author (RRN), using the described method, identifying the studies related to the topic by considering titles and abstracts, and duplicated studies were excluded. An additional analysis excluded studies that did not meet the criteria in full. Articles that met all criteria were obtained in full text, and two authors (RRN and OVV) revised the selected texts. Inter-examiner conflicts were solved by a third author (CTM) in a consensus meeting. The data extraction from studies was carried out by

two authors (RRN and CTM), including year of publication, study design and characteristics of the participants, follow-up, diagnostic methods, types of measurement of outcomes, and statistical methods used. The main outcomes evaluated were: 1. Differences between initial (T1) and final (T2) values in mandibular plane-SN angle, and in anterior facial height measurements (total, superior, lower and the ratio between these measures); 2. The relationship between changes in these variables and the normalization of the breathing pattern. The latest research in databases was held in November 2014, adjusted monthly to PubMed and Web of Science until July 2015. The search strategies for each electronic database are shown in Table 7 (Appendix).

Table 2. Descriptors used in the search strategy.

	Keywords
Group 1	(head[MeSH Terms] OR head[tiab] OR “head posture”[tiab] OR "maxillofacial development"[MeSH Terms] OR "maxillofacial development"[tiab] OR face[tiab] OR “facial growth”[tiab] OR “facial development”[tiab] OR “facial pattern”[tiab] OR “facial patterns”[tiab] OR “facial morphology”[tiab] OR “craniofacial growth”[tiab] OR “facial growth direction”[tiab] OR "vertical dimension"[MeSH Terms] OR "vertical dimension"[tiab] OR “lower face height”[tiab] OR “dentition”[MeSh Terms] OR “dentition”[tiab] OR "dental occlusion"[MeSH Terms] OR "dental occlusion"[tiab] OR "malocclusion"[MeSH Terms] OR "malocclusion"[tiab] OR “mandible”[MeSH Terms] OR “mandible”[tiab] OR chin[MeSH Terms] OR chin[tiab] OR “maxilla”[MeSH Terms] OR “maxilla”[tiab] OR “jaw”[MeSH Terms] OR “jaw”[tiab])
Group 2	("respiration"[MeSH Terms] OR “respiration”[tiab] OR "mouth breathing"[MeSH Terms] OR “mouth breathing”[tiab] OR respiratory mechanics[tiab] OR respiratory pattern[tiab] OR respiratory patterns[tiab] OR oral breathing[tiab] OR oral breathers[tiab] OR buccal breathing[tiab] OR buccal breathers[tiab] OR mouth respiration[tiab] OR mouth breather[tiab] OR upper airways[tiab] OR "nasopharynx"[MeSH Terms] OR nasopharynx[tiab] OR nasal airflow[tiab] OR nasopharyngeal airways[tiab] OR “adenoids”[MeSH] OR adenoids[tiab])
Group 3	(“cephalometry”[Mesh Terms] OR cephalometry[tiab] OR “teleradiology”[Mesh Terms] OR teleradiology[tiab] OR radiographic analysis[tiab] OR “lateral cephalogram” [tiab] OR “lateral cephalograms”[tiab] OR “lateral radiographs”[tiab] OR “cone-beam computed tomography”[Mesh Terms] OR “cone-beam computed tomography”[tiab] OR “cone beam CT”[tiab] OR “cone beam”[tiab] OR “computerized tomography”[tiab]

The selected articles were assessed for methodological qualification. Due to their characteristics, the studies were assessed according to the Methodological Index for Non-Randomized Studies (MINORS)[20], a checklist developed to evaluate non-randomized surgical studies (Table 3).

Table 3. Assessment of methodological quality-based on the MINORS.

Assessed itens		Score*
1	A clearly stated aim	
2	Inclusion of consecutive patients	
3	Prospective collection of data	
4	Endpoints appropriate to the aim of the study	
5	Unbiased assessment of the study endpoint	
6	Follow-up period appropriate to the aim of the study	
7	Loss to follow-up less than 5%	
8	Prospective calculation of the study size	
9	An adequate control group	
10	Contemporary groups	
11	Baseline equivalence of groups	
12	Adequate statystical analysis	

* The itens are scored 0 (not reported), 1 (reported but inadequate), or 2 (reported and adequate).

RESULTS

The research in electronic databases identified 1555 titles and abstracts. The duplicated articles (519) were removed. The search process is shown in Figure 1.

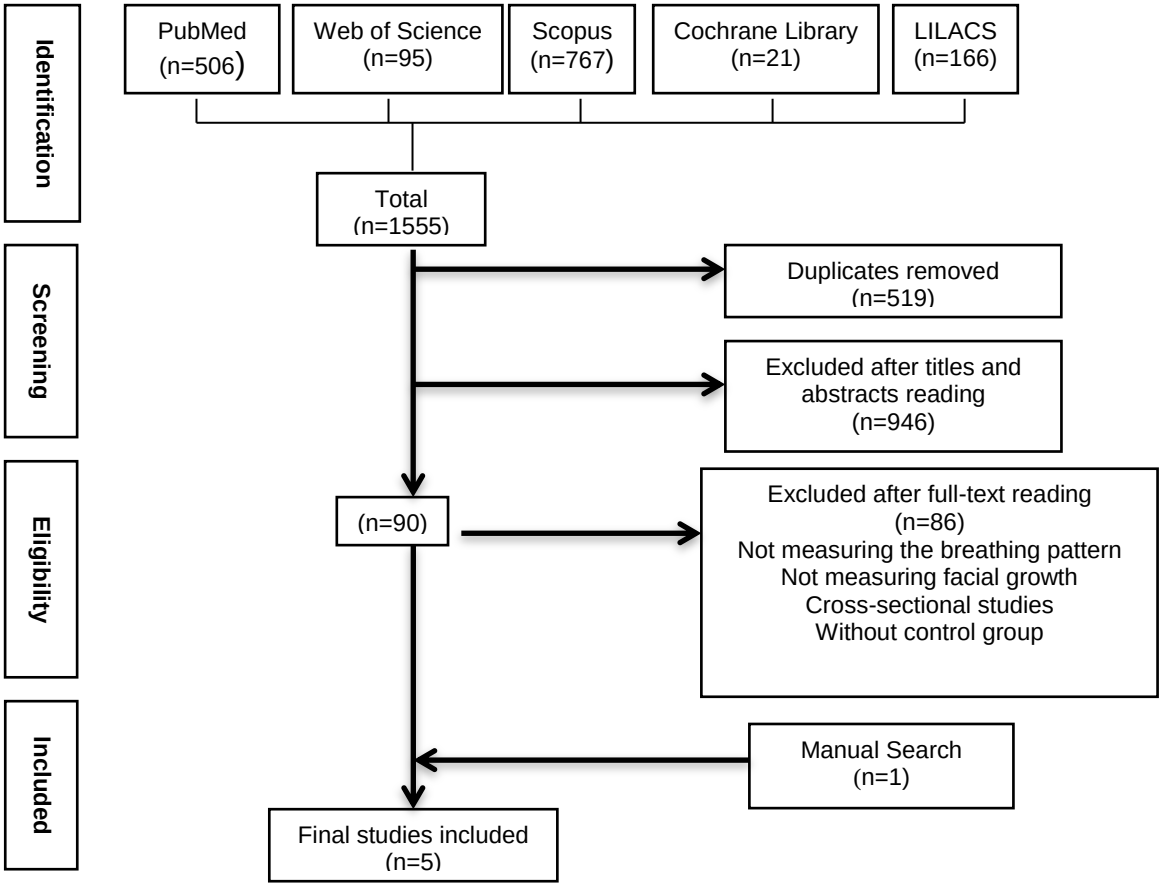

Figure 1. *PRISMA flow diagram* of the selected studies.

All remaining titles and abstracts (1036) were analysed, and 946 were considered inadequate and, subsequently, excluded. The full texts of 90 studies were evaluated. Finally, four articles that fully met the inclusion criteria were selected. A single article was selected by manual search,[21] and a total of five articles were included in the present work. The details of the selected studies are included in Table 4.

Table 4. Characteristics of the included studies.

Author / year	Study design	Experimental Group N (gender) Mean age (years) Intervention	Control Group N (gender) Mean age (years)	Follow-up (months)	Statystical analysis
Mattar et al. 2011	PS	33 (nr) 4,8 (T1) 7,2 (T2) Adenoidectomy / adenotonsillectomy	22 (nr) 5,1 - T1 7,4 - T2	28	- D'Agostino-Pearson normality test; - Student's *t* test
Zettergren et al. 2006	PS	17 (10M, 7F) 5,6±1,34 - T1 10,9±1,37 - T2 Adenoidectomy / adenotonsillectomy / tonsillectomy	17 (10M,7F) 5,8 ± 1,40 - T1 10,7±1,43 - T2	60	- Student's *t* test; - *F*-test; - ANOVA; - Mauchly's test; - Greenhouse-Geisser correction; - *post hoc* multiple comparison test (including Bonferroni corrections); - Dahlberg's formula
Mahony et al. 2004	RS	45 -T1* 36 -T2 (nr) 7,5±1,7 -T1 Adenoidectomy	35 - T1* 30 - T2 (nr) 7,9±1,7 - T1	60	- Student's *t* test; - Pearson correlation coefficient; - Dahlberg's formula
Kerr et al. 1989	RS	26 (17M, 9F) 8,2±1,6, - T1 13,6 ± 1,6 - T2 Adenoidectomy	26 (17M, 9F) 8,4±1,6 - T1 13,0±1,7 - T2	60	- Student's *t* test
Linder-Aronson et al. 1986	RS	Swedish sample 38 (22M, 16F) 7,5 Adenoidectomy	37 (20M 17F) 7,9 226 (117M, 109F)	60	- Student's *t* test; - *F*-test

**60% male and 40% female of the eighty children at T1.*
PS=prospective study; RS=retrospective study; nr=not reported; T1=initial; T2= final; M=male; F=female; EG=experimental group; CG= control group.

After application of the inclusion criteria, two prospective[21,22] and three retrospective studies,[3,23,24] all of them non-randomized, were selected. Three studies[3,23,24] used the same sample,[8] and one study[21] used the experimental

group from another work.[25] In the five studies, the control group (CG) and experimental group (EG) were compared, and the latter underwent adenoidectomy, tonsillectomy, or adenotonsillectomy, due to extreme respiratory obstruction.

All studies were included in this review because they presented distinct variables. The follow-up time ranged from 28[22] to 60 months.[3,21-24] Significant differences in angular measurements between the control and experimental groups were reported in four studies.[3,21-24]

The methods for evaluating the breathing pattern were the history of individuals, followed by oroscopy and rhinoscopy,[22] polysomnography,[21] and posterior rhinomanometry.[3,23,24] In three studies, the reference to the original sample[8] revealed that this assessment was performed before treatment and repeated at one, three and five years of follow-up. One work[21] reports that the breathing pattern reassessments were made in the experimental group, and another study[22] reports that individuals who presented recurrent respiratory problems were excluded. These assessments confirmed the change in the respiratory pattern in the experimental group, from oral to nasal breathing.

Linear and angular measurements were assessed in three studies,[3,21,22] one[23] evaluated only linear measurements, and another used only angular measurements.[24]

The quality assessment of the included studies, according to MINORS,[20] is shown in Table 5. The item was scored ‘0’ (not reported), ‘1’ (reported but inadequate), or ‘2’ (reported and adequate). The studies were classified, according to their score, as low (>18), medium (≥12 to ≤18), and high risk of bias (<12). All the selected articles were considered with moderate risk of bias.

Table 5. Methodological quality assessment of the selected studies.

MINORS itens	Mattar et al.	Zettergren et al.	Mahony et al.	Kerr et al.	Linder-Aronson et al.
1. A clearly stated aim	2	2	2	2	2
2. Inclusion of consecutive patients	2	2	2	2	2
3. Prospective collection of data	0	0	0	0	0
4. Endpoints appropriate to the aim of the study	2	2	2	2	2
5. Unbiased assessment of the study endpoint	0	0	0	0	0
6. Follow-up period appropriate to the aim of the study	2	2	2	2	2
7. Loss to follow-up less than 5%	0	2	0	2	0
8. Prospective calculation of the study size	0	0	0	0	0
9. An adequate control group	2	2	2	2	2
10. Contemporary groups	2	0	2	2	2
11. Baseline equivalence of groups	2	0	2	2	2
12. Adequate statystical analysis	2	2	2	2	2
Score	**16**	**14**	**16**	**18**	**16**

Table 6 shows the comparisons between means in the experimental and control groups at T1 and T2. Three studies[3,21,23] reported significant differences in linear measures concerning the AFH. In T1, Zettergren et al.[21] reported differences between the experimental and control groups ($p<0.05$). Mahony et al.[23] found significant differences between groups in the lower AFH, in the ratio of the upper and the lower AFH ($p<0.001$), and an association between changes in this facial proportion and breathing pattern ($p<0.01$). The results of Kerr et al.[3] showed that significant differences in the lower ($p<0.05$) and total AFH ($p <0.01$) between the groups, at T1, continued to exist in T2. Additionally, measurements of mandibular dimensions identified a significant increase ($p<0.01$) in the mandibular body length in the experimental group compared with the control in T2.

The selected studies assessed different variables, therefore it was impossible to perform a meta-analysis as it was unfeasible to make comparisons.

Table 6. Comparison of the initial and final variables of the selected studies.

Mattar et al.	**Initial comparison of the variables for the EG and CG groups (means)**				**Comparison of measurement between T1 and T2 (mean)**						**Comparison of the variation of the measures (T2-T1) between EG and CG**		
	Variables	**EG (T1)**	**CG (T1)**	*p*	**EG**			**CG**			**EG T2-T1**	**CG T2-T1**	*p*
					T1	T2	*P*	T1	T2	*P*			
	SN-GoGn (degrees)	41.2±4.8	36.6±4.8	<0.001	41.2±4.8	38.8±5.1	<0.0001	36.6±4.8	36.6±5.3	Ns	−2.3±2.6	0.0±3,0	0.004
	ArGo-GoMe (degrees)	136.9±3.6	131.3±3.2	<0.001	136.9±3.6	133.4±3.6	<0.0001	131.3±3.2	134.2±5.4	0.02	−3.5± 2.6	2.9±5.4	<0.0001
	BaN.PtGn (degrees)	84.2±3.9	88.2±3.2	<0.0001	84.2±3.9	86.0±3.9	<0.0001	88.2±3.2	89.0±3.0	ns	1.9±2.3	0.8±2.1	ns
	Comparison of cephalometric measurements of MB and NB groups in T2 (means)												
		EG		CG			*p*						
	Sn-GoGn (degrees)	38.8±5.1		3.6±5.3			n.s.						
	ArGo-GoMe (degrees)	133.4±3.6		134.2±5.4			n.s.						
	BaN.PtGn (degrees)	86.6±3.9		89.0±3.0			0.004						
	SN-GoGn=mandibular plane inclination ; PP-MP=maxilla and mandible relationship in the vertical plane; ArGo-GoMe = gonial angle; BaN-PtGn = variation in anterior face height and face depth; n.s. = not significant.												
	AUTHORS' CONCLUSIONS: In the pre-treatment, the experimental group (EG) had higher values for the mandibular plane angle, more obtuse gonial angle and dolichofacial predominant pattern compared to the control group (CG). After treatment, the experimental group showed significant normalization in the growth direction, with a decrease in the mandibular plane and gonial angles. However, the dolichofacial pattern still prevailed in the experimental group at the end of the follow-up.												
Zettergren et al.	**Cephalometric variables (degrees), line (mm) and proportion (%)**												
		Difference between means of EG and CG (T1)		*P*			Difference between means of EG and CG (T2)			*p*			
	ML/NSL (degrees)	4.5±6.50		0.012*			2.5±7.62			0.184			
	NL/NSL (degrees)	−2.5±2.48		0.001***			−1.2±3.49			0.182			
	sp'-gn" (mm)	2.5±4.68		0.047*			2.4±6.44			0.139			
	s'-p'/n'-gn' (%)	1.8±2.87		0.018*			1.5±3.69			0.113			
	ML/NSL= mandibular plane inclination; NL/NSL= maxilla's inclination; sp'-gn" = lower anterior face height; s'-p'/n'-gn'= ratio of lower anterior face height to total anterior face height												
	AUTHORS' CONCLUSIONS: The experimental group (EG) presented different dentofacial morphology of the control group (CG) at baseline. After treatment, the dentofacial morphology of the experimental group was normalized.												
Mahony et al.	**Comparison of means between the experimental group (EG) and control (CG)**												
		EG T1− CG T1		*P*			**EG T2 − CG T2**			*p*			
		n=45	n=35				n=36	n=30					
	N-ANS (mm)	46.3±3.09 – 45.3±3.57		1.36 ns			52.4±3.24	51.2±3.75		1.40 n.s.			
	ANS-Me (mm)	62.7±4.79 – 58.7±3.70		4.25**			68.4±6.48	63.8±4.68		3.36*			
	$\frac{\mathrm{N}-\mathrm{ANS}}{\mathrm{ANS}-\mathrm{Me}}$ (%)	0.72± 0.06 – 0.78 ± 0.07		−4.25**			0.78±0.07	0.8±0.06		−1.42 ns			
	Association between changes in the variables (from T1 to T2) and the breathing pattern												
		N		**r**									
	N-ANS (mm)	65		0.08 n.s.									
	ANS-Me (mm)	66		0.19 n.s.									
	$\frac{\mathrm{N}-\mathrm{ANS}}{\mathrm{ANS}-\mathrm{Me}}$ (%)	65		0.032*									
	*N-ANS = upper anterior face height; ANS-Me = lower anterior face height; N-ANS/ANS-Me = ratio of upper anterior face height to lower anterior face height; n.s. = not significant; *p<0.01; **p<0.001*												
	AUTHORS' CONCLUSIONS: Changes observed between the ratio of the total anterior facial height to lower anterior facial height, after treatment of the experimental group (EG), may be associated with change in oral to nasal breathing pattern after adenoidectomy.												

<table>
<tr><td rowspan="8">Kerr et al.</td><td colspan="4">Comparisons between the mean differences in variables of the experimental group (EG) and control (CG)</td></tr>
<tr><td></td><td colspan="3">EG vs CG</td></tr>
<tr><td></td><td>(T1)</td><td>1 year</td><td>5 years (T2)</td></tr>
<tr><td>ML/SNL (degrees)</td><td>3.27±6.88*</td><td>2.40±7.12</td><td>2.30±8.51</td></tr>
<tr><td>sn.me (mm)</td><td>2.77 ± 5.99</td><td>3.09±5.70**</td><td>3.34±7.62*</td></tr>
<tr><td>n.me (mm)</td><td>4.47±7.02**</td><td>4.22±7.44**</td><td>5.04±9.54**</td></tr>
<tr><td>cd-Xi/Xi-pm(degrees)</td><td>0.48±6.43</td><td>0.98±7.07</td><td>1.94±6.15</td></tr>
<tr><td>Xi-pm (mm)</td><td>0.73±3.25</td><td>1.14±3.51</td><td>2.53±4.27**</td></tr>
<tr><td colspan="4">ML/SNL= mandibular plane inclination; sn.me = lower anterior face height; n.me = total anterior face height; Xi-pm= mandibular body lenght; cd-Xi/Xi-pm= mandibular arch
* P<0.05 ** P<0.01</td></tr>
<tr><td></td><td colspan="4">AUTHORS' CONCLUSIONS:
The change in breathing pattern seemed to influences favorably the rotation and shape of the mandible, which produces more forward growth direction in the experimental group (EG). Although differences in anterior facial height between the experimental group (EG) and control (CG) had been developed during the postoperative period, individuals from the experimental group became less dolichocephalic at the end of the follow-up.</td></tr>
<tr><td rowspan="9">Linder-Aronson et al.</td><td colspan="6">Comparisons of the mandibular growth direction in the experimental (EG) and control groups(CG)
(Swedish sample)</td></tr>
<tr><td></td><td colspan="2">GC</td><td colspan="2">GE</td><td colspan="2">Diferences</td></tr>
<tr><td></td><td>20M</td><td>17F</td><td>22M</td><td>16F</td><td>M</td><td>F</td></tr>
<tr><td>Angle 3 ($\bar{x}$ ± SD)</td><td>62.1±10.9</td><td>72.3±9.4</td><td>58.1±18.0</td><td>60.8±16.0</td><td>4.0 ns</td><td>11.5 (P<0.02)</td></tr>
<tr><td>($\bar{x}$)</td><td>2.4</td><td>2.3</td><td>2.9</td><td>4.0</td><td></td><td></td></tr>
<tr><td colspan="6">Comparison between the Swedish experimental group (EG) who had more horizontal growth, with Swedish and Canadian control groups (CG)</td></tr>
<tr><td></td><td colspan="5">Crescimento mais horizontal que $\bar{x}$ ±SD</td></tr>
<tr><td></td><td colspan="2">M</td><td colspan="2">F</td><td colspan="2">Total</td></tr>
<tr><td>Swedish(20M/17F)</td><td colspan="2">45% (n=10)</td><td colspan="2">31% (n=5)</td><td colspan="2">39% (n=15)</td></tr>
<tr><td>Canadian (117M-109F)</td><td colspan="2">64% (n=14)</td><td colspan="2">31% (n=5)</td><td colspan="2">50% (n=19)</td></tr>
<tr><td colspan="6">Angle 3= resulting from the Gn point and SN line superimpositions, representing the total mandibular growth forward during the five years postoperative; ($\bar{x}$ ± SD)= mean±standard deviation; ($\bar{x}$)=mean of method error;ns= not significant</td></tr>
<tr><td colspan="6">AUTHORS' CONCLUSIONS:
There was an association between the change in breathing pattern in the experimental group (EG), from oral to nasal, and the establishment of a more horizontal growth of the mandible.</td></tr>
</table>

T1 = initial; T2 = final; M = male; F = female; EG = experimental group; CG = control group.

DISCUSSION

Several studies compared the cephalometric values between nasal and mouth breathers, and identified significant differences between the two groups.[1,16,17,26-37] Some authors, however, have suggested that cross-sectional studies tend to select individuals with specific facial features to study the mode of breathing.[1,16] They have also pointed out the need for longitudinal studies, monitoring the facial growth, in patients who received treatment for the correction of the breathing pattern at an early age. According to these authors, only in this way would it be possible to determine whether the mode of breathing was able to implement such differences, or if these differences were the predisposing or supporting factor to the establishment of an altered breathing pattern.[1,7,16,28,31,34-36]

Therefore, our paper evaluated longitudinal studies, with a follow-up time equal to or higher than one year, to obtain cephalometric measurements that reflect changes in the MGD and AFH, in developing patients who normalized their mode of breathing, comparing them with untreated nasal-breather control groups.

This systematic review found a small number of longitudinal studies with significant samples, and all of them have presented moderate risk of bias. Of the five selected studies,[3,21-24] three[3,23,24] used individuals from the same sample.[8] Zettergren et al.[21] reported that the sample used in their study had 17 subjects in the experimental group from a previous study,[25] and the experimental and control groups were matched according to gender and chronological and dental age. However, it was impracticable to obtain a sufficient number of longitudinal cephalometric records of nasal-breathing Swedish children between three and six years, making it necessary to complete the control group with six records from a British longitudinal study.[38] Linder-Aronson et al.,[24] reported that, due to the discrepancy in results between the female and male groups, the sample was biased. Nevertheless, the study showed significant differences in the female group, which could not be demonstrated in the male group. Therefore, the authors used a control group from a Canadian sample.[39]

In three studies,[3,21,22] significant differences in the mandibular plane inclination were observed between the experimental and control groups at T1. The experimental group used by Mattar et al.[22] had a gonial angle (ArGo-GoMe) significantly more obtuse than the control group at T1 ($p<0.001$). Following the establishment of nasal breathing, significant reduction in this variable was observed ($p<0.0001$). This finding suggests that the morphology of the mandible can be influenced by the mode of breathing.[16] Kerr et al.[3] tried to assess changes in the inclination between the ramus and the mandibular body (mandibular arch). They observed an increase, but not statistically significant, in the difference between the experimental and control groups at follow-up. On the other hand, when assessing the mandibular body length, the author found almost identical means when comparing the two groups at T1, while a significant difference ($p<0.01$) was observed in T2. They concluded that, although the mandibular inclination had shown little improvement, the symphyseal outline was more enhanced in the experimental group, suggesting the establishment of a more horizontal growth pattern after a change in the breathing pattern.

Linder-Aronson et al.[24] subdivided the experimental and control groups of a sample of Swedish children according to gender. Significant horizontal growth of the mandible ($p<0.02$) was found when comparing the female experimental group with the corresponding control. The Swedish female experimental group showed the same percentage of girls with horizontal mandibular growth after breathing normalization when compared with girls of a Canadian sample[38] used as control (31%). The male experimental group showed the same mandibular growth trend, but without statistical significance. The authors concluded that there is an association between the change in breathing pattern and the establishment of a more horizontal MGD.

In three studies[3,21,23] initial significant differences were found related to the anterior dimensions of the face. Kerr et al.[3] and Zettergren et al.[21] reported significantly higher differences in total and lower AFH, and in the ratio of these dimensions[21] in the experimental group compared to the control.

Kerr et al.[3] also reported that, although the total AFH and lower AFH remained significantly higher in the experimental group by the end of follow-up, it did not increase notably in this group. Zettergren et al.[21] found that, initially,

the mandibular plane inclination was reflected in lower facial height and in the ratio of the total AFH and lower AFH, which were significantly higher in the experimental group. After five years of follow-up, both groups showed similar values for these variables. These findings suggest that the normalization of the breathing pattern had a favourable effect both in establishing smaller vertical alterations, as well as in preventing more pronounced increases for the AFH.

Mahony et al.[23] observed such significant differences only for the lower AFH, which was higher for the experimental group at T1 and T2. Between T1 and T2 both groups had significant increases in this variable. In the control group, the proportion between the AFH and lower AFH decreased. However, no significant difference between groups was found at the end of the follow-up. According to the authors, the lower AFH increased in the experimental group at T1 was the cause of this finding, but disappeared during the follow-up period, when the mode of breathing was normalized. A significant correlation ($p<0.01$) was related to the ratio between the facial heights and the change in breathing mode.

By analysing the BaN-PtGn angle, Mattar et al.[22] observed that, in T1, the experimental group had a predominantly dolichofacial pattern. In T2, the comparison of different measurements revealed that all measures were significantly similar, except in this variable, which was significantly lower in the experimental group, showing the persistence of a dolichofacial pattern in patients, even after surgery.

One can agree with Vargervik et al.[40] and Tommer and Harvold[41] when they stated that an altered breathing pattern may be, at least, a predisposing factor for the development of differences in facial growth, due to the influence of the tongue, jaw and head posture during the development phase. The relief of mouth breathing allows postural correction, thereby favouring, the re-establishment of the mandibular growth direction. In fact, in the experimental groups, comparisons of cephalometric records[3,21,24] showed that the largest changes in MGD occurred in the first year. In the following years, despite continuing to be favourable, these changes were less expressive.

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4. CONCLUSÕES

Quando o padrão respiratório muda de oral para nasal nos indivíduos em crescimento**,** a direção de crescimento mandibular torna-se mais horizontal. A altura facial anterior pode não apresentar alterações significativas, ou diminuir em decorrência do crescimento mais horizontal da mandíbula.

5. ANEXOS

Tabela 7 . Estratégias de buscas para cada base de dados.

Base	Estratégias de busca
MEDLINE via PubMed http://www.ncbi.nlm.nih.gov/pubmed	(head[MeSH Terms] OR head[tiab] OR “head posture”[tiab] OR "maxillofacial development"[MeSH Terms] OR "maxillofacial development"[tiab] OR face[tiab] OR “facial growth”[tiab] OR “facial development”[tiab] OR “facial pattern”[tiab] OR “facial patterns”[tiab] OR “facial morphology”[tiab] OR “craniofacial growth”[tiab] OR “facial growth direction”[tiab] OR "vertical dimension"[MeSH Terms] OR "vertical dimension"[tiab] OR “lower face height”[tiab] OR “dentition”[MeSh Terms] OR “dentition”[tiab] OR "dental occlusion"[MeSH Terms] OR "dental occlusion"[tiab] OR "malocclusion"[MeSH Terms] OR "malocclusion"[tiab] OR “mandible”[MeSH Terms] OR “mandible”[tiab] OR chin[MeSH Terms] OR chin[tiab] OR “maxilla”[MeSH Terms] OR “maxilla”[tiab] OR “jaw”[MeSH Terms] OR “jaw”[tiab]) AND ("respiration"[MeSH Terms] OR “respiration”[tiab] OR "mouth breathing"[MeSH Terms] OR “mouth breathing”[tiab] OR respiratory mechanics[tiab] OR respiratory pattern[tiab] OR respiratory patterns[tiab] OR oral breathing[tiab] OR oral breathers[tiab] OR buccal breathing[tiab] OR buccal breathers[tiab] OR mouth respiration[tiab] OR mouth breather[tiab] OR upper airways[tiab] OR "nasopharynx"[MeSH Terms] OR nasopharynx[tiab] OR nasal airflow[tiab] OR nasopharyngeal airways[tiab] OR “adenoids”[MeSH] OR adenoids[tiab]) AND (“cephalometry”[Mesh Terms] OR cephalometry[tiab] OR “teleradiology”[Mesh Terms] OR teleradiology[tiab] OR radiographic analysis[tiab] OR “lateral cephalogram” [tiab] OR “lateral cephalograms”[tiab] OR “lateral radiographs”[tiab] OR “cone-beam computed tomography”[Mesh Terms] OR “cone-beam computed tomography”[tiab] OR “cone beam CT”[tiab] OR “cone beam”[tiab] OR “computerized tomography”[tiab]
Web of Science http://www.webofknowledge.com	TS=(head OR "head posture" OR "maxillofacial development" OR face OR "facial growth" OR "facial development" OR "facial pattern" OR "facial patterns" OR "facial morphology" OR "craniofacial growth" OR "facial growth direction" OR "vertical dimension" OR "lower face height" OR dentition OR "dental occlusion" OR malocclusion OR mandible OR chin OR maxilla OR jaw) AND TS=(respiration OR “mouth breathing” OR “respiratory mechanic” OR “respiratory mechanics” OR “respiratory pattern” OR “respiratory patterns” OR “oral breathing” OR “oral breathers” OR “buccal breathing” OR “buccal breather” “buccal breathers” OR “mouth respiration” OR “mouth breather” OR “mouth breather” OR “upper airways” OR nasopharynx OR “nasal airflow” OR “nasopharyngeal airway” “nasopharyngeal airways” OR adenoids) AND TS=(“cephalometry” OR “teleradiology” OR “radiographic analysis” OR “lateral cephalogram” OR “lateral cephalograms” OR “lateral radiograph” OR “lateral radiographs” OR “cone-beam computed tomography” OR “cone beam CT” OR “cone beam” OR “computerized tomography”)
Scopus http://www.scopus.com	(head OR “head posture” OR "maxillofacial development" OR face OR “facial growth” OR “facial development” OR “facial pattern” OR “facial patterns” OR “facial morphology” OR “craniofacial growth” OR “facial growth direction” OR "vertical dimension") OR (“lower face height” OR dentition OR "dental occlusion” OR malocclusion OR mandible OR chin OR maxilla OR jaw) AND (respiration OR “mouth breathing” OR “respiratory mechanic” OR “respiratory mechanics” OR “respiratory pattern” OR “respiratory patterns” OR “oral breathing” OR “oral breathers” OR “buccal breathing” OR “buccal breather” OR “buccal breathers”) OR (“mouth respiration” OR “mouth breather” OR “mouth breathers” OR “upper airways” OR nasopharynx OR “nasal airflow” OR “nasopharyngeal airway” OR “nasopharyngeal airways” OR adenoids) AND (cephalometry OR teleradiology OR “radiographic analysis” OR “lateral cephalogram” OR “lateral cephalograms” OR “lateral radiograph” OR “lateral radiographs” OR “cone-beam computed tomography” OR “cone beam CT” OR “cone beam” OR “computerized tomography”)
The	ID Search

Cochrane Library http://www.thecochranelibrary.com/view/0/index.html	#1	"head":ti,ab,kw (Word variations have been searched)
	#2	MeSHdescriptor: [Head] explode all trees
	#3	#1 or #2
	#4	maxillofacialdevelopment:ti,ab,kw (Word variationshavebeensearched)
	#5	MeSHdescriptor: [MaxillofacialDevelopment] explode alltrees
	#6	#4 or #5
	#7	"vertical dimension":ti,ab,kw (Word variationshavebeensearched)
	#8	MeSHdescriptor: [Vertical Dimension] explode alltrees
	#9	#7 or #8
	#10	"dentition":ti,ab,kw (Word variationshavebeensearched)
	#11	MeSHdescriptor: [Dentition] explode alltrees
	#12	#10 or #11
	#13	"dental occlusion":ti,ab,kw (Word variationshavebeensearched)
	#14	MeSHdescriptor: [Dental Occlusion] explode alltrees
	#15	#13 or #14
	#16	"malocclusion":ti,ab,kw (Word variationshavebeensearched)
	#17	MeSHdescriptor: [Malocclusion] explode alltrees
	#18	#16 or #17
	#19	"mandible":ti,ab,kw (Word variationshavebeensearched)
	#20	MeSHdescriptor: [Mandible] explode alltrees
	#21	#19 or #20
	#22	"chin":ti,ab,kw (Word variationshavebeensearched)
	#23	MeSHdescriptor: [Chin] explode alltrees
	#24	#22 or #23
	#25	"maxilla":ti,ab,kw (Word variationshavebeensearched)
	#26	MeSHdescriptor: [Maxilla] explode alltrees
	#27	#25 or #26
	#28	"jaw":ti,ab,kw (Word variationshavebeensearched)
	#29	MeSHdescriptor: [Jaw] explode alltrees
	#30	#28 or #29
	#31	#3 or #6 or #9 or #12 or #15 or #18 or #21 or #24 or #27 or #30
	#32	"headposture":ti,ab,kw (Word variationshavebeensearched)
	#33	"face":ti,ab,kw (Word variationshavebeensearched)
	#34	"facial growth":ti,ab,kw (Word variationshavebeensearched)
	#35	"facial development":ti,ab,kw (Word variationshavebeensearched)
	#36	"facial pattern":ti,ab,kw (Word variationshavebeensearched)
	#37	"facial morphology":ti,ab,kw (Word variationshavebeensearched)
	#38	"craniofacial growth":ti,ab,kw (Word variationshavebeensearched)
	#39	"facial growthdirection":ti,ab,kw (Word variationshavebeensearched)
	#40	"lower face height":ti,ab,kw (Word variationshavebeensearched)
	#41	#32 or #33 or #34 or #35 or #36 or #37 or #38 or #39 or #40
	#42	#31 or #41
	#43	"respiration":ti,ab,kw (Word variationshavebeensearched)
	#44	MeSHdescriptor: [Respiration] explode alltrees
	#45	#43 or #44
	#46	"mouthbreathing":ti,ab,kw (Word variationshavebeensearched)
	#47	MeSHdescriptor: [MouthBreathing] explode alltrees
	#48	#46 or #47
	#49	"nasopharynx":ti,ab,kw (Word variationshavebeensearched)
	#50	MeSHdescriptor: [Nasopharynx] explode alltrees
	#51	#49 or #50
	#52	adenoid:ti,ab,kw (Word variationshavebeensearched)
	#53	MeSHdescriptor: [Adenoids] explode alltrees
	#54	#52 or #53
	#55	"respiratoymechanics":ti,ab,kw (Word variationshavebeensearched)
	#56	"respiratorypattern":ti,ab,kw (Word variationshavebeensearched)
	#57	"oral breathing":ti,ab,kw (Word variationshavebeensearched)
	#58	"oral breathers":ti,ab,kw (Word variationshavebeensearched)
	#59	"buccalbreathing":ti,ab,kw (Word variationshavebeensearched)
	#60	"mouthrespiration":ti,ab,kw (Word variationshavebeensearched)
	#61	"mouthbreather":ti,ab,kw (Word variationshavebeensearched)
	#62	"upperairways":ti,ab,kw (Word variationshavebeensearched)
	#63	"nasal airflow":ti,ab,kw (Word variationshavebeensearched)
	#64	"nasopharyngealairways":ti,ab,kw (Word variationshavebeensearched)
	#65	#45 or #48 or #51
	#66	#55 or #56 or #57 or #58 or #59 or #60 or #61 or #62 or #63 or #64
	#67	#65 or #66

	#68 "cephalometry":ti,ab,kw (Word variationshavebeensearched) #69 MeSHdescriptor: [Cephalometry] explode alltrees #70 #68 or #69 #71 "teleradiology":ti,ab,kw (Word variationshavebeensearched) #72 MeSHdescriptor: [Teleradiology] explode alltrees #73 #71 or #72 #74 "cone-beamcomputedtomography":ti,ab,kw (Word variationshavebeensearched) #75 MeSHdescriptor: [Cone-BeamComputedTomography] explode alltrees #76 #74 or #75 #77 "radiographicanalysis":ti,ab,kw (Word variationshavebeensearched) #78 "lateral cephalogram":ti,ab,kw (Word variationshavebeensearched) #79 "lateral radiograph":ti,ab,kw (Word variationshavebeensearched) #80 "cone beam CT":ti,ab,kw (Word variationshavebeensearched) #81 "cone beam":ti,ab,kw (Word variationshavebeensearched) #82 "computerizedtomography":ti,ab,kw (Word variationshavebeensearched) #83 #77 or #78 or #79 or #80 or #81 or #82 #84 #70 or #73 or #76 #85 #83 or #84 #86 #42 and #67 and #85
LILACs (Latin American and Caribbean Center on Health Sciences Information) http://www.bireme.br	(tw:(MH:“cabeça” OR MH:“dimensão vertical” OR MH:“dentição” OR MH:“oclusãodentária” OR MH: “máoclusão” OR MH: “mandibular” OR MH: “queixo” OR MH: “maxilla”)) OR (head OR cabeça OR cabeza OR maxillofacial development OR desenvolvimentomaxilofacial OR desarollomaxilofacial OR face OR cara OR facial growth OR crescimento facial OR crecimiento facial OR facial development OR desenvolvimento facial OR desarollo facial OR facial pattern OR padrão facial OR patrón facial OR craniofacial growth OR crescimento craniofacial OR crecimientocraneofacial OR vertical dimension OR dimensão vertical OR dimensión vertical OR dentition OR dentição OR dentición OR dental occlusion OR oclusãodentária OR oclusión dental OR malocclusion OR máoclusão OR maloclusión OR mandible OR mandíbula OR chin OR queixo OR mentón OR maxilla OR maxila OR maxilar OR jaw) AND (tw:(MH: “respiração” OR MH: “respiraçãobucal” OR MH: “nasofaringe” OR MH: “tonsil faríngea”)) OR (respiration OR respiração OR respiración OR mouth breathing OR respiraçãobucal OR respiraciónpor la boca OR oral breathing OR oral breathers OR buccal breathing OR respiraciónbucal OR buccal breathers OR respiradoresbucais OR respiradoresbucales OR upper airways OR viasaéreassuperiores OR víasrespiratoriassuperiores OR nasopharynx OR nasofaringe OR nasopharyngeal airways OR viasaéreasnasofaríngeas OR víasrespiratoriasnasofaríngeas OR adenoids OR adenóides OR adenoides) AND (tw:(MH:“telerradiologia” MH: “tomografia computadorizada de feixe cônico”)) OR (cephalometry OR cefalometria OR cefalometría OR teleradiology OR telerradiologia OR telerradiología OR lateral cephalogram OR cefalograma lateral OR lateral cephalograms OR cefalogramas laterais OR cefalogramaslaterales OR cone-beamcomputedtomography OR tomografia computadorizada de feixe cônico OR tomografia computarizada de haz cónico OR cone-beamcomputedtomography OR tomografia computadorizada volumétrica OR tomografia computarizada OR cone beam CT OR TC de feixe cônico OR TC de haz cónico)