UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ODONTOLOGIA DE BAURU

WILANA DA SILVA MOURA

# Position of the mandibular incisors, gingival recession and airway dimensions after treatment with Jasper Jumper: 10-year follow-up

# Posição dos incisivos inferiores, recessão gengival e dimensões das vias aéreas após o tratamento com Jasper Jumper: 10 anos de acompanhamento

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Tese constituída por artigos apresentada à Faculdade de Odontologia de Bauru da Universidade de São Paulo para obtenção do título de Doutor em Ciências no Programa de Ciências Odontológicas Aplicadas, na área de concentração Ortodontia.

Orientador: Prof. Dr. José Fernando Castanha Henriques.

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FOLHA DE APROVAÇÃO

# DEDICATÓRIA

À minha avó **Maria do Socorro**, mulher guerreira, sempre a frente do seu tempo, exemplo de vida, força e coragem!

Aos meus pais **Lourival e Maria da Cruz**, exemplos de amor e superação, vencedores que nunca esqueceram suas origens e princípios, e que souberam repassar isso muito bem para seus filhos!

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"Tudo que parece impossível, é impossível até que seja feito."

**Nelson Mandela**

# ABSTRACT

# ABSTRACT

## Position of the mandibular incisors, gingival recession and airway dimensions after treatment with Jasper Jumper: 10-year follow-up

**Introduction:** The aim of this study was to evaluate long-term results regarding position and gingival recession of the mandibular incisors, and airway dimensions after treatment with the Jasper Jumper appliance. **Material and Methods:** The patients were divided in 2 groups: Jasper group was constituted of 16 patients treated with Jasper Jumper appliance for a mean period of 2.06 years (SD, 0.21) and evaluated in the follow-up period of 11.88 years (SD, 0.49). The mean initial age was of 12,49 years (SD, 1.61), the mean final age of 14.55 years (SD, 1.17), and the mean age at the follow-up of 26.43 years (SD, 1.24); Control group was constituted of 16 age-matched untreated Class II patients. Results from the treated group were compared to cross-sectional measurements obtained from lateral cephalograms of untreated Class II individuals matched to the age, skeletal age and sex distribution with the treated patients in each time of evaluation (T1, T2, and T3). The presence of gingival recession, the extent of gingival recession, and the position of the mandibular incisors were evaluated in intraoral photographs, digital models, and lateral cephalograms at 3 stages in the Jasper group. Skeletal and airway dimensions were evaluated using Dolphin Imaging software in both groups. Statistical analyses were performed by Dependent t, Wilcoxon, Pearson's Correlation, Repeated measures ANOVA, Independent t and Mann-Whitney tests, at $P < 0.05$. **Results:** The presence of gingival recession increased over time and was observed in 6 (9.4%), 12 (18.8%), and 24 (37.5%) of the teeth at pretreatment, posttreatment, and follow-up, respectively. There was a significant increase in labial inclination and protrusion of the mandibular incisors after treatment and a significant increase in the extent of the gingival recession in the follow-up period and in the long-term total time. There was no correlation between the extent of gingival recession and the labial inclination and protrusion of the mandibular incisors. Minimal sagittal skeletal changes were observed in both groups. Vertical skeletal dimensions and clockwise rotation of the occlusal plane were significantly greater in the Jasper group than in the Control group at T2 and T3. The lower airway was significantly greater in the Jasper group than in the Control group at T2. The upper and lower airway were similar in both groups at T3. **Conclusion:** Correlation between

the extent of gingival recession, and the labial inclination and protrusion of the mandibular incisors was not observed. The lower airway was significantly greater in the Jasper group than in the Control group at T2, but at T3 significant difference between the groups was not observed.

**Keywords:** Functional Orthodontic Appliance; Gingival Recession; Oropharynx; Orthodontic Treatment; Orthodontic Tooth Movement

# RESUMO

# RESUMO

## Posição dos incisivos inferiores, recessão gengival e dimensões das vias aéreas após o tratamento com Jasper Jumper: 10 anos de acompanhamento

**Objetivo:** O objetivo desse estudo foi avaliar resultados em longo prazo relacionados à posição e recessão gengival dos incisivos inferiores e dimensões das vias aéreas após o tratamento com o aparelho Jasper Jumper. **Material e Métodos:** Os pacientes foram divididos em 2 grupos: o grupo Jasper foi constituído por 16 pacientes tratados com o aparelho Jasper Jumper por um período médio de 2,06 anos (DP, 0,21) e avaliados no período de acompanhamento de 11,88 anos (DP, 0,49), a idade média no pré-tratamento (T1) foi de 12,49 anos (DP, 1,61), a idade média no pós-tratamento (T2) foi de 14,55 anos (DP, 1,17) e idade média no acompanhamento (T3) foi de 26,43 anos (DP, 1,24); O grupo Controle foi constituído por 16 pacientes com má oclusão de Classe II não tratados. Os resultados do grupo tratado (Jasper) foram comparados com medidas transversais obtidas a partir das radiografias cefalométricas laterais de indivíduos Classe II não tratados pareados com a idade, idade esquelética e distribuição sexual com os pacientes tratados em cada momento de avaliação (T1, T2 e T3). A presença da recessão gengival, a extensão da recessão gengival e o posicionamento dos incisivos inferiores foram avaliadas em fotografias intraorais, modelos digitais e radiografias cefalométricas no grupo Jasper. As dimensões esqueléticas e das vias aéreas foram avaliadas usando o software Dolphin Imaging em ambos os grupos. As análises estatísticas foram realizadas através dos testes Dependent t, Wilcoxon, Pearson's Correletion, ANOVA de medidas repetidas, Independen t e Mann-Whitney, at $P< 0.05$. **Resultados:** A presença de recessão gengival aumentou ao longo do tempo e foi observada em 6 (9,4%), 12 (18,8%) e 24 (37,5%) dos dentes no pré-tratamento, pós-tratamento e acompanhamento, respectivamente. Houve um aumento significativo na vestibularização e protrusão dos incisivos inferiores após o tratamento e um aumento significativo na extensão da recessão gengival no período de acompanhamento e no tempo total de acompanhamento. Não houve correlação entre a extensão de recessão gengival e vestibularização e protrusão dos incisivos inferiores. Alterações esqueléticas sagitais mínimas foram observadas nos dois grupos. As dimensões esqueléticas verticais e a rotação no sentido horário do plano oclusal foram significativamente maiores no grupo

Jasper comparados ao grupo Controle no T2 e T3. A via aérea inferior foi significativamente maior no grupo Jasper quando comparada ao grupo Controle no T2. As vias aéreas superior e inferior foram semelhantes nos dois grupos no T3. **Conclusão:** Não foi observada correlação entre a extensão da recessão gengival e a vestibularização e protrusão dos incisivos inferiores. A via aérea inferior foi significativamente maior no grupo Jasper quando comparada ao grupo Controle no T2, mas no T3 não houve diferença significativa entre os grupos.

**Palavras-chave:** Aparelhos Ortodônticos Funcionais; Recessão Gengival; Orofaringe; Tratamento Ortodôntico; Técnicas de Movimentação Dentária.

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**ARTICLE 1**



**ARTCLE 2**

# LIST ABREVIATIONS AND ACRONYMS

T1: Timing 1

T2: Timing 2

T3: Timing 3

SD: Standard deviation

T2-T1: Changes that occurred during treatment period

T3-T2: Changes that occurred during follow-up period

T3-T1: Changes that occurred in long-term total time.

OSA: Obstructive sleep apnea syndrome

MAD: Mandibular advancement devices

CPAP: Continuous positive airway pressure

RCT: Randomized controlled trials

FFA: Fixed functional appliances

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# 1 INTRODUCTION

# 1 INTRODUCTION

Class II malocclusion is the most common orthodontic problem. This malocclusion occurs between 15-30% in different population (ELKORDY; ABOUELEZZ; SALAH FAYED; ATTIA *et al.*, 2015; SILVA; KANG, 2001; VASQUEZ; BACCETTI; FRANCHI; MCNAMARA, 2009) and mandibular deficiency is the predominant component. (CANÇADO; PINZAN; JANSON; HENRIQUES *et al.*, 2008; DE ALMEIDA-PEDRIN; HENRIQUES; DE ALMEIDA; DE ALMEIDA *et al.*, 2009; JANSON; JANSON; NAKAMURA; DE FREITAS *et al.*, 2008) There are many methods of treatment to Class II malocclusion, such as, headgear appliance, removable functional appliance, fixed functional appliance, Class II intermaxillary elastics, tooth extractions and orthodontic-surgical treatments. (DA COSTA GREC; JANSON; BRANCO; MOURA-GREC *et al.*, 2013; DE FREITAS; DE LIMA; DE FREITAS; JANSON *et al.*, 2009; FRANCISCONI; HENRIQUES; JANSON; FREITAS *et al.*, 2013; GUIMARÃES; HENRIQUES; JANSON; MOURA, 2015; GUIMARÃES JR; HENRIQUES; JANSON; DE ALMEIDA *et al.*, 2012; OLTRAMARI-NAVARRO; JANSON; DE OLIVEIRA; QUAGLIO *et al.*, 2010) The choice of treatment method must be performed according to the correct diagnostics. Fixed functional appliances are frequently used in the cases that patients presented mandibular deficiency. (JANSON; SATHLER; FERNANDES; BRANCO *et al.*, 2013; MORO; JANSON; DE FREITAS; HENRIQUES *et al.*, 2009)

The first fixed functional appliance was introduced by Herbst in 1905 and modified by Pancherz in 1979. (PANCHERZ, 1979) Because functional appliance is fixed, some advantages were related to this appliance, especially the little necessity of patient's cooperation. Thus, several other models of fixed functional appliance appeared to simplify the use, to facilitate the realization of orthodontic treatment, and to improve the acceptance of treatment by patients. (GUIMARÃES JR; HENRIQUES; JANSON; DE ALMEIDA *et al.*, 2012; NEVES; JANSON; CANÇADO; DE LIMA *et al.*, 2014)

Evidences (ISHAQ; ALHAMMADI; FAYED; EL-EZZ *et al.*, 2016; ZYMPERDIKAS; KORETSI; PAPAGEORGIOU; PAPADOPOULOS, 2015) related that fixed functional appliances have mainly dentoalveolar effects rather than skeletal

effects and that these appliances are effective in correction of Class II malocclusion. One of the dentoalveolar effects promoted by fixed mandibular appliance is labial inclination and protrusion of mandibular incisors, irrespective of growth phase. (ISHAQ; ALHAMMADI; FAYED; EL-EZZ *et al.*, 2016; KORETSI; ZYMPERDIKAS; PAPAGEORGIOU; PAPADOPOULOS, 2014; PERINETTI; PRIMOŽIČ; FURLANI; FRANCHI *et al.*, 2014) In 2016, a systematic review performed by Zymperdikas et al. (ZYMPERDIKAS; KORETSI; PAPAGEORGIOU; PAPADOPOULOS, 2015) showed a mean increase in IMPA angle of 7.99º in the patients treated with fixed functional appliance when compared to untreated patients.

James Jasper introduced a fixed functional appliance in 1987, the Jasper Jumper is a device to advance the mandible composed by flexible force modules. The flexibility of this appliance minimizes the problems caused by rigidity of other fixed functional appliances, offering more movement liberty. Furthermore, this appliance presented advantages, such as, treatment total time reduction, because the Jasper Jumper appliance can be used together with fixed appliance, therefore the orthodontic treatment can be performed only in a phase. (DE LIMA; HENRIQUES; JANSON; DA COSTA PEREIRA *et al.*, 2013)

Nalbantgil et al. (NALBANTGIL; ARUN; SAYINSU; IŞIK, 2005) evaluated the skeletal, dental, and soft-tissue changes in patients treated with Jasper Jumper. The results showed no significant changes in the vertical skeletal parameters, the upper molars tipped distally as the lower molars tipped mesially, the occlusal plane rotated in the clockwise direction, overbite and overjet were reduced, the soft-tissue profile improved significantly, the maxillary incisors were retruded, and the mandibular incisors were protruded and vestibularized. Other studies that evaluated the skeletal and dental effects of Japer Jumper appliance also observed similar results in regarding the vestibularization and protrusion of mandibular incisors. (BASSARELLI, TURI; FRANCHI, LORENZO; DEFRAIA, EFISIO; MELSEN, BIRTE, 2016; DE LIMA; HENRIQUES; JANSON; DA COSTA PEREIRA *et al.*, 2013; HERRERA; HENRIQUES; JANSON; FRANCISCONI *et al.*, 2011)

Gingival recession is characterized by apical displacement of gingiva that lead the other consequences, as the appearing of caries lesions, dentin hypersensitivity and esthetic problems. (JATI; FURQUIM; CONSOLARO, 2016; LEE; ONG; YEO, 2017;

MAZUROVA; RENKEMA; NAVRATILOVA; KATSAROS *et al.*, 2015; SALTI; HOLTFRETER; PINK; HABES *et al.*, 2017; WARMUZ; JAGIELAK; BOTZENHART; SEELIGER *et al.*, 2016) Many causes are associated with the appearing of gingival recession, and some studies observed a relation between the presence of gingival recession and the realization of orthodontic treatment. (BOKE; GAZIOGLU; AKKAYA; AKKAYA, 2014; BOLLEN; CUNHA-CRUZ; BAKKO; HUANG *et al.*, 2008; RENKEMA; FUDALEJ; RENKEMA; KIEKENS *et al.*, 2013; SHARMA; MANGAT; KICHORCHANDRA; HANDA *et al.*, 2017; SLUTZKEY; LEVIN, 2008)

A possible justification to the appearance of gingival recession after orthodontic treatment would be the presence, of bone dehiscence, due to the realization of orthodontic movements against the cortical plate. In this context, the labial movement of mandibular incisors promoted by fixed functional appliances would be a problem. (SHARMA; MANGAT; KICHORCHANDRA; HANDA *et al.*, 2017) According to Garib et al. (GARIB; YATABE; OZAWA; SILVA FILHO, 2010) the alveolar bone morphology constitution should be individually considered in the orthodontic treatment planning and dental arch expansion and incisor buccal-lingual movements are considered the most critical orthodontic movement.

Schwartz et al. (SCHWARTZ; RAVELI; SCHWARTZ-FILHO; RAVELI, 2016) evaluated alveolar bone loss around mandibular incisors after treatment with Herbst appliance through CBCT scans and observed an association between the Herbst appliance and alveolar bone loss on the buccal surface of mandibular incisors. However, some studies that evaluated the relation between the increase in inclination of the mandibular incisors and the presence of gingival recession did not observe this association. (ALLAIS; MELSEN, 2003; ANTONARAKIS; JOSS; TRIACA; KUIJPERS-JAGTMAN *et al.*, 2017; CLOSS; GREHS; RAVELI; RÖSING, 2009; DJEU; HAYES; ZAWAIDEH, 2002; MORRIS; CAMPBELL; TADLOCK; BOLEY *et al.*, 2017; RENKEMA; NAVRATILOVA; MAZUROVA; KATSAROS *et al.*, 2014; RUF; HANSEN; PANCHERZ, 1998) Also, a systematic review performed by Tepedino et al. (TEPEDINO, M.; FRANCHI, L.; FABBRO, O.; CHIMENTI, C., 2018) evaluated the correlation between gingival recession/ bone height and incisor inclination. In this review, just two studies were included in the qualitative analysis. The authors concluded that there is no strong scientific evidence that labial inclination of incisors promoted by fixed orthodontic appliances can affect gingival recession.

The effects of Herbst treatment combined with a lingual and labial appliances in regard to lower incisor gingival recessions were compared and analyzed by Bock et al. (BOCK; RUF; WIECHMANN; JILEK, 2016) The results showed that both treatment exhibited vestibularization and protrusion of the mandibular incisors, but no clinically relevant gingival recessions were seen. Pancherz et al. (PANCHERZ; BJERKLIN, 2014) performed a study to analyze the long-term results after treatment with Herbst appliance in regarding the inclination and alignment of mandibular incisors and presence of gingival recession. The authors observed the presence of minimal gingival recession after treatment. The presence of gingival recession was associated with translation movement of mandibular incisors and not with degree of inclination. However, due to small sample size, statistical analysis was not performed. The results were presented individually and the author's conclusions according to individual description of each case.

Despite the use of low-quality studies, a systematic review performed by Bock et al. (BOCK; VON BREMEN; RUF, 2015) showed good stability for the majority of variables evaluated when therapy with fixed functional appliance was used to treatment of Class II malocclusion. (BOCK; VON BREMEN; RUF, 2015; QUAGLIO; DE FREITAS; DE FREITAS; JANSON *et al.*, 2011) However, the presence of gingival recession was not evaluated in this study.

Airway have relation to craniofacial growth, and it is a great practical concern to otorhinolaryngologists, pediatricians, orthodontists and other health care professions. (MCNAMARA, 1981) According to article that searched to clarify the positions of the medical societies about snoring and obstructive sleep apnea syndrome (OSA), the orthodontist is important to the identification of pharyngeal obstruction sites, in the evaluation and treatment of maxillomandibular discrepancies with orthopedic and/or surgical options, and in treatment of OSA and snoring with mandibular advancement devices (MAD). The orthodontists are in special position for several reasons, including easy access to cephalometric lateral radiograph, exam routinely requested by these professionals that allows to evaluate airways size and morphology. (CHAVES JUNIOR; DAL-FABBRO; BRUIN; TUFIK *et al.*, 2011)

MAD have been used successfully to treatment of OSA and snoring. Despite of treatment with continuous positive airway pressure (CPAP) be considered gold

standard, studies related more compliance of patients when MAD are used. (FERGUSON; ONO; LOWE; AL-MAJED *et al.*, 1997; RAMAR; DORT; KATZ; LETTIERI *et al.*, 2015; WHITE; SHAFAZAND, 2013) MAD are intraoral appliances used to prevent upper airway collapse by protruding the mandible forward. (BASYUNI; BARABAS; QUINNELL, 2018) Comparison between MAD and placebo through randomized controlled trials (RCT) have established the efficacy of MAD over placebo, suggesting that the mechanism of action occurs through mandibular protrusion. (ANDRÉN; HEDBERG; WALKER-ENGSTRÖM; WAHLÉN *et al.*, 2013; PETRI; SVANHOLT; SOLOW; WILDSCHIØDTZ *et al.*, 2008; VANDERVEKEN; DEVOLDER; MARKLUND; BOUDEWYNS *et al.*, 2008)

Functional appliances are devices used to advancement of mandible and to treatment of Class II malocclusion with mandibular deficiency. There are many functional appliances and, in general, the difference between them is related to design and type of appliance (fixed or removable, rigidity or flexible). (BOCK; VON BREMEN; RUF, 2015; ZYMPERDIKAS; KORETSI; PAPAGEORGIOU; PAPADOPOULOS, 2015) The Jasper Jumper is an example of a flexible fixed functional appliance. Because these appliances have mechanism of action similar to MAD, several studies searched to evaluate effects of functional appliances in airway dimensions. (ALI; SHAIKH; FIDA, 2015; BAVBEK; TUNCER; TURKOZ; ULUSOY *et al.*, 2016; ERBAS; KOCADERELI, 2014; RIZK; KULBERSH; AL-QAWASMI, 2016)

A systematic review performed by Anusuya et al. (ANUSUYA; JENA; SHARAN, 2019) to assess the pharyngeal airway dimensions after treatment of Class II malocclusion with functional appliance selected 8 studies that used 6 different appliances. The authors concluded that functional appliance treatment has a significant effect on the improvement of the oropharyngeal airway. But they also observed that different methodologies were used and that yet there are many aspects about the researched question, such as, which appliance is better in increasing the airway dimensions, which dimensions of pharyngeal airway is most improved and long-term posttreatment stability of the changes.

There is no study in literature that evaluated long-term results after treatment with Jasper Jumper appliance regarding the gingival recession and airway dimensions. Therefore, the aim of this study was to evaluate long-term results regarding the position

and gingival recession of the mandibular incisors, and airway dimensions after treatment with the Jasper Jumper appliance.

# 4 FINAL CONSIDERATIONS

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Presence of gingival recession increased over time. There was a significant increase in labial inclination and protrusion of the mandibular incisors in posttreatment period and a significant increase in the gingival recession in the follow-up period, but clinically these changes were irrelevant (< 1mm). Correlation between the extent of gingival recession, and the labial inclination and protrusion of the mandibular incisors was not observed. The lower airway was significantly greater in the Jasper group than in the Control group at T2, but at T3 significant difference between the groups was not observed.

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# ANNEXES

# ANNEXES

**ANNEX A** - Research Institutional Board approval, protocol number 1.567.403 (front)

USP - FACULDADE DE ODONTOLOGIA DE BAURU DA USP

## PARECER CONSUBSTANCIADO DO CEP

**DADOS DO PROJETO DE PESQUISA**

**Título da Pesquisa:** INCLINAÇÃO DO INCISIVO INFERIOR E RECESSÃO GENGIVAL APÓS TERAPIA COM JASPER JUMPER: CONTROLE DE 10 ANOS PÓS TRATAMENTO

**Pesquisador:** Wilana Moura

**Área Temática:**

**Versão:** 4

**CAAE:** 71683617.3.0000.5417

**Instituição Proponente:** Universidade de Sao Paulo

**Patrocinador Principal:** Financiamento Próprio

**DADOS DO PARECER**

**Número do Parecer:** 2.505.559

**Apresentação do Projeto:**

Idem ao Parecer 2.390.153

**Objetivo da Pesquisa:**

Idem ao Parecer 2.390.153

**Avaliação dos Riscos e Benefícios:**

Idem ao Parecer 2.390.153

**Comentários e Considerações sobre a Pesquisa:**

Pendências descritas no Parecer 2.389.775.

1. No TCLE a frase: " Caso alguma alteração que necessite de tratamento seja observada, inclusive em relação a recessão gengival, o senhor(a) será encaminhado para realização do tratamento sem custos com a especialidade adequada". Deve ser alterada para: " Caso alguma alteração que necessite de tratamento seja observada, inclusive em relação a recessão gengival, o senhor(a) será encaminhado para a TRIAGEM DA FOB. - ATENDIDA

**Considerações sobre os Termos de apresentação obrigatória:**

Todos os termos forma apresentados

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**Telefone:** (14)3235-8356 **Fax:** (14)3235-8356 **E-mail:** cep@fob.usp.br

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**Recomendações:**

Atualizar o cronograma no projeto e na PB e enviar como Notificação

**Conclusões ou Pendências e Lista de Inadequações:**

Atualizar o cronograma no projeto e na PB e enviar como Notificação

**Considerações Finais a critério do CEP:**

Esse projeto foi considerado APROVADO na reunião ordinária do CEP de 07/02/2018, com base nas normas éticas da Resolução CNS 466/12. Ao término da pesquisa o CEP-FOB/USP exige a apresentação de relatório final. Os relatórios parciais deverão estar de acordo com o cronograma e/ou parecer emitido pelo CEP. Alterações na metodologia, título, inclusão ou exclusão de autores, cronograma e quaisquer outras mudanças que sejam significativas deverão ser previamente comunicadas a este CEP sob risco de não aprovação do relatório final. Quando da apresentação deste, deverão ser incluídos todos os TCLEs e/ou termos de doação assinados e rubricados, se pertinentes.

**Este parecer foi elaborado baseado nos documentos abaixo relacionados:**

| Tipo Documento | Arquivo | Postagem | Autor | Situação |
|---|---|---|---|---|
| Informações Básicas do Projeto | PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_948158.pdf | 21/11/2017 19:43:29 | | Aceito |
| TCLE / Termos de Assentimento / Justificativa de Ausência | tcle211117.pdf | 21/11/2017 19:41:51 | Wilana Moura | Aceito |
| Projeto Detalhado / Brochura Investigador | projeto211118.pdf | 21/11/2017 19:41:14 | Wilana Moura | Aceito |
| Declaração de Instituição e Infraestrutura | aquiescenciaortodontia.pdf | 13/09/2017 13:52:12 | Wilana Moura | Aceito |
| Declaração de Instituição e Infraestrutura | aquiescenciaradiologia.pdf | 13/09/2017 13:51:58 | Wilana Moura | Aceito |
| Outros | questionario.pdf | 18/07/2017 21:02:38 | Wilana Moura | Aceito |
| Declaração de Pesquisadores | declaracao.pdf | 18/07/2017 20:57:02 | Wilana Moura | Aceito |
| Folha de Rosto | folha.pdf | 18/07/2017 20:52:47 | Wilana Moura | Aceito |

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**Situação do Parecer:**
Aprovado

**Necessita Apreciação da CONEP:**
Não

BAURU, 21 de Fevereiro de 2018

**Assinado por:**
**Ana Lúcia Pompéia Fraga de Almeida**
**(Coordenador)**

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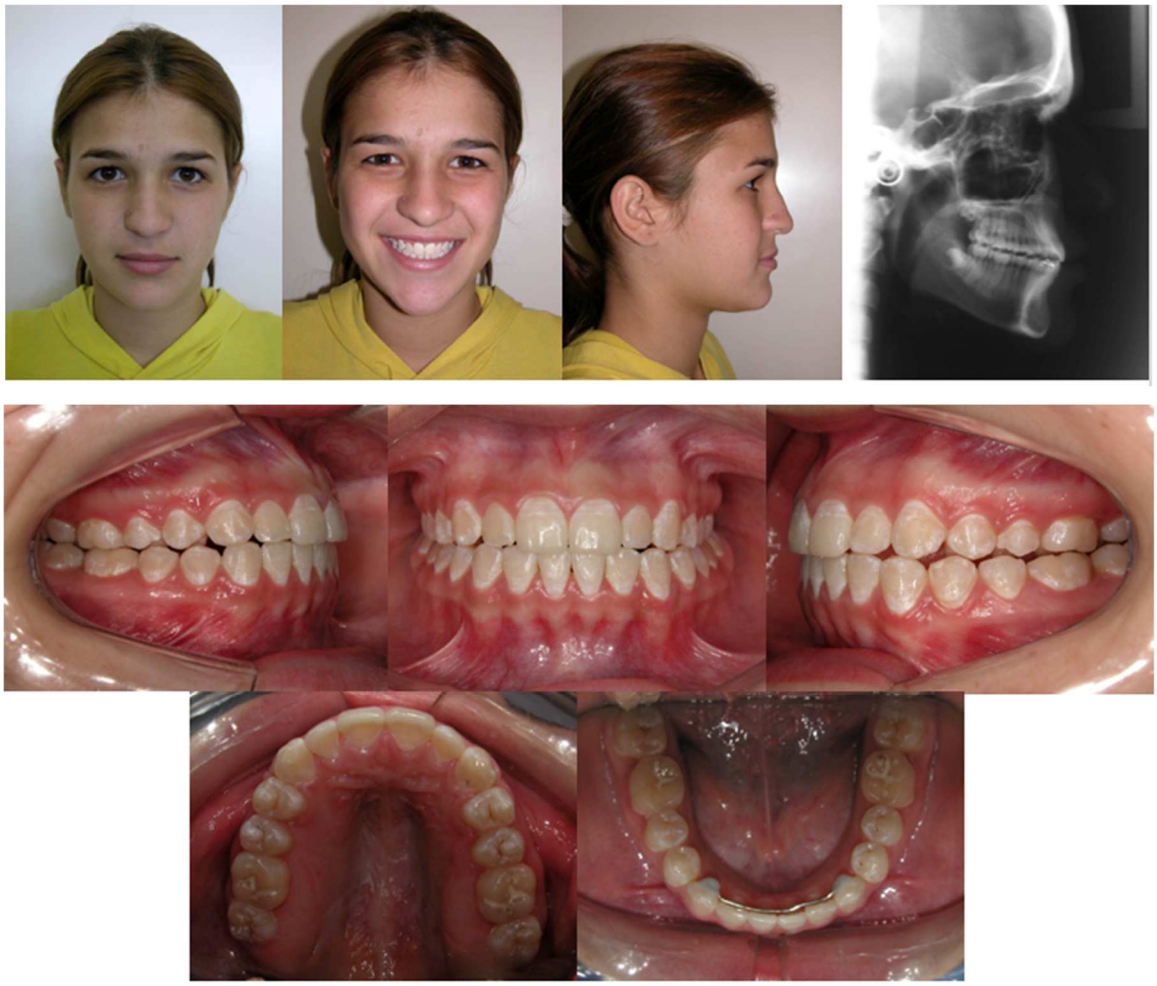
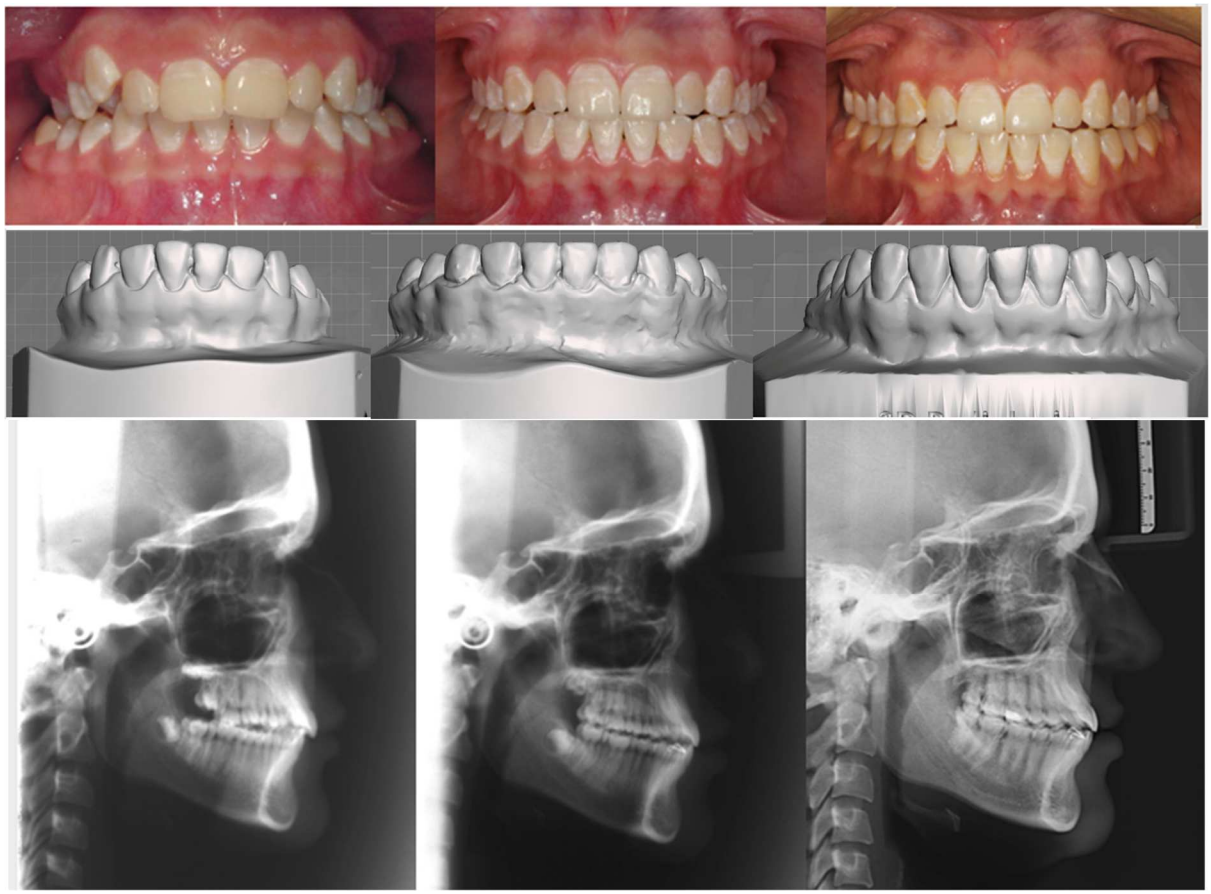
**ANNEX B - One of the patients that illustrates the main facial and occlusal features presented by the sample patients treated with the Jasper Jumper appliance.**





**T1** **T2** **T3**

## ANNEX C - Guidelines for AJO-DO submissions: Original Article

ELSEVIER

# AMERICAN JOURNAL OF ORTHODONTICS AND DENTOFACIAL ORTHOPEDICS

Official Journal of the American Association of Orthodontists, its constituent societies, the American Board of Orthodontics, and the College of Diplomates of the American Board of Orthodontics

**AUTHOR INFORMATION PACK**

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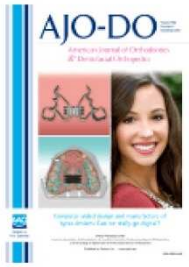


**ISSN:** 0889-5406

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These guidelines are supplemental to the Guidelines for Original Articles, which describe how to meet general submission requirements, such as figure formats, reference style, required releases, and blinding.

*Systematic Review and Meta-Analysis Guide for Authors*

You can access a link to an annotated example of a Model Orthodontic Systematic Review. Further explanation of reporting practices is given in the accompanying Explanation and Elaboration document. These documents have been prepared in accordance with PRISMA guidelines and the "PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies that Evaluate Health Care Interventions: Explanations and Elaboration" (http://www.plosmedicine.org/article/info:doi/10.1371/journal.pmed.1000100).

However, we have made these guidelines more relevant to orthodontics and have adapted the reporting template to encourage transparent and pertinent reporting by introducing subheadings corresponding to established PRISMA items.

Further information on reporting of systematic reviews can also be obtained in the Cochrane Handbook for Systematic Reviews of Interventions (http://www.cochrane-handbook.org).

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