UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ODONTOLOGIA DE BAURU

PAULA PATRÍCIA COTRIN DA SILVA

Long-term comparison of occlusal relapse in cases treated with and without premolar extraction

Comparação da recidiva oclusal em longo-prazo em casos tratados com e sem extração de pré-molares

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Orientador: Prof. Dr. Marcos Roberto de Freitas

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“Nobody said it was easy
It's such a shame for us to part
Nobody said it was easy
No one ever said it would be this hard
Oh take me back to the start”.

The Scientist, Coldplay

ABSTRACT

Long-term comparison of occlusal relapse in cases treated with and without premolar extraction

Objective: The aim of this study was to compare the occlusal relapse in nonextraction and extraction orthodontic treatments in the long-term. **Material and methods:** The sample comprised 57 Class I and Class II malocclusion patients were divided into 2 groups: Group 1: 16 patients treated nonextraction, with mean initial, final and long-term posttreatment ages of 13.20, 15.07 and 50.32 years, respectively. Mean treatment and long-term follow-up times were 1.86 and 35.25 years. Group 2: 41 patients treated with 4-premolars extraction, with mean initial, final and long-term posttreatment ages of 13.31, 15.63 and 53.60 years, respectively. Mean treatment and long-term follow-up times were 2.32 and 37.96 years. Dental casts were obtained and digitized at pretreatment (T1), posttreatment (T2) and long-term posttreatment (T3) stages. The following measurements were obtained: Little irregularity Index, arch length and perimeter, intercanine, interpremolar and intermolar widths, PAR and OGS indexes. The subjects also answered an on-line questionnaire on the esthetic and occlusal self-perception at T3. Intergroup comparison was performed with independent t tests. **Results:** At the long-term, all arch dimensions, except intercanine width, were significantly smaller in the extraction group. Both groups showed similar amount of relapse and arch dimension changes in the long-term, except for the mandibular arch perimeter. The percentage of mandibular anterior crowding relapse was significantly greater in nonextraction (84.46%) than in extraction group (44.66%). PAR index improved with treatment and relapsed at the long-term in both groups. Nonextraction group showed greater relapse according to OGS index than extraction cases. Nonextraction patients perceived more changes in alignment over time than extraction individuals, but overall satisfaction was similar. **Conclusions:** There was no difference in the amount of long-term relapse of anterior crowding and transversal arch dimensions in cases treated with and without extraction. The percentage of relapse of mandibular anterior crowding was significantly higher in the nonextraction than in the extraction group. Mandibular arch perimeter showed more decrease in the long-term in extraction cases. The nonextraction group showed more occlusal relapse and perceived more changes in alignment over time, but overall patient satisfaction was similar for both groups.

Keywords: Malocclusion. Relapse. Stability. Tooth extraction.

RESUMO

Comparação da recidiva oclusal em longo-prazo em casos tratados com e sem extração de pré-molares

Objetivo: O objetivo deste trabalho foi comparar a recidiva oclusal em longo prazo em casos ortodônticos tratados com e sem extrações dentárias. **Material e métodos**: A amostra foi constituída por 57 pacientes com má oclusão de Classe I e II, divididos em 2 grupos: Grupo 1: 16 pacientes tratados sem extração, com média de idade inicial, final e longo prazo de 13,20, 15,07 e 50,32 anos, respectivamente. Os tempos médios de tratamento e avaliação em longo prazo foram 1,86 e 35,25 anos. Grupo 2: 41 pacientes tratados com extrações de pré-molares, com média de idade inicial, final e longo prazo pós-tratamento de 13,31, 15,63 e 53,60 anos, respectivamente. Os tempos médios de tratamento e avaliação em longo prazo foram 2,32 e 39,96 anos. Os modelos de gesso iniciais (T1), finais (T2) e longo prazo pós-tratamento (T3) foram obtidos e digitalizados. As seguintes medidas foram obtidas: Índice de Irregularidade de Little, comprimento e perímetro do arco, distâncias intercaninos, interpré-molares e intermolares, índices PAR e OGS. Os pacientes também responderam a um questionário on-line sobre sua autopercepção estética e oclusal no longo prazo pós-tratamento. A comparação intergrupos foi realizada pelo teste t independente. **Resultados**: Em longo prazo, todas as dimensões dos arcos, exceto a distância intercaninos, foram significativamente menores no grupo com extração. Ambos os grupos apresentaram quantidade semelhante de recidiva e alterações na dimensão dos arcos em longo prazo, exceto no perímetro do arco inferior. A porcentagem de recidiva do apinhamento anteroinferior foi significativamente maior no grupo sem extração (84,46%) do que no grupo com extração (44,66%). O índice PAR melhorou com o tratamento e recidivou em longo prazo em ambos os grupos. O grupo sem extração apresentou maior recidiva de acordo com o índice OGS do que os casos com extração. Pacientes sem extração perceberam mais alterações no alinhamento ao longo do tempo do que indivíduos com extração, mas a satisfação em geral foi semelhante. **Conclusões**: Não houve diferença na quantidade de recidiva em longo prazo do apinhamento anterior e nas dimensões transversais dos arcos nos casos tratados com e sem extração. A porcentagem de recidiva do apinhamento anteroinferior foi significativamente maior no grupo sem extração do que no grupo com extração. O perímetro do arco inferior apresentou maior diminuição a longo prazo nos casos de extração. O grupo sem extração mostrou mais recidiva oclusal e percebeu mais alterações no alinhamento ao longo do tempo, mas a satisfação geral do paciente foi semelhante nos dois grupos.

Palavras-chave: Má oclusão. Recidiva. Estabilidade. Extrações dentárias.

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T1	Pretreatment
T2	Posttreatment
T3	Long-term posttreatment follow-up
T2 – T1	Treatment changes
T3 – T2	Relapse
Mx	Maxilla
Md	Mandible
SD	Standard deviation
3-3 width	Intercanine width
5-5 width	Interpremolar width
6-6 width	Intermolar width
PAR	Peer Assessment Rating
OGS	Objective Grading System
C-R	Cast and radiograph

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1 INTRODUCTION

1 INTRODUCTION

If dental professionals were asked about their orthodontic treatment goals, they might mention pleasant smiles, good occlusal function and mainly stability of the results obtained over the years. Long-term stability of orthodontic treatment has been extensively studied and difficult to predict.(Dyer; Vaden; Harris, 2012; Freitas et al., 2017; Little, 1999) Besides that, it is known that dental occlusion is dynamic. Changes will occur regardless of the technique, appliance and treatment protocol used. These changes can be desired by the orthodontist, called “settling of the occlusion”(Dincer; Meral; Tumer, 2003) or not, causing great discomfort for the clinician and the patient, the much-feared “relapse”. It is of paramount importance to determine if some trait of the orthodontic treatment might improve or worsen over time.

Relapse of the mandibular anterior segment during the postretention period is perhaps the most predictable and frustrating of all orthodontic relapses.(Shah, 2003) Relapse is defined as the tendency for the teeth to move from the positions in which they were placed by the orthodontics. Some authors, however, prefer to call it physiologic recovery, that is the changes that represent a rebound or reversion toward the original malocclusion.(Horowitz; Hixon, 1969) The long-term response of the anterior alignment is unpredictable; no variables, such as degree of initial crowding, age, sex and Angle classification is useful in establishing a prognosis.(Little, 1990) Typically, arch width and length decrease after retention, regardless of treatment expansion or constriction. Two thirds of the patients have unsatisfactory mandibular anterior alignment after retention.(Erdinc; Nanda; Isiksal, 2006; Freitas et al., 2004; Little; Wallen; Riedel, 1981)

The evaluation of the orthodontic treatment outcomes for a long time was subjective, so in this context, the orthodontists’ experience determined his success or failure. The ideal parameter for orthodontic treatments finishing was based on the six keys to normal occlusion.(Andrews, 1972) The use of objective criteria is essential to uniformly quantify and measure the severity of malocclusions, the efficacy of different treatment modalities as well to assess the relapse of orthodontic treatments.(Chalabi et al., 2015) Attempts have recently been made to evaluate treatments in a more

objective way,(Otuyemi; Jones, 1995b) allowing clinicians worldwide to speak the same language regarding the orthodontic treatment outcomes. In this context, the Peer Assessment Rating (PAR index) and the American Board of Orthodontics Objective Grading System (OGS) are two of the most used indexes to evaluate treatment outcomes and stability.(Casko et al., 1998; DeGuzman et al., 1995; Richmond et al., 1992a; Richmond et al., 1992b)

The PAR Index was developed to measure treatment outcomes in orthodontics(Richmond et al., 1992a; Richmond et al., 1992b) and its validity was improved by weighting the scores of some components to reflect their relative importance.(DeGuzman et al., 1995) More recently, in order to assess the adequacy of finished orthodontic results, The American Board of Orthodontics (ABO) developed a model grading system (Objective Grading System OGS) as an occlusal index to evaluate posttreatment dental casts.(Casko et al., 1998) It assesses the final occlusion of treated cases.

Follow-up studies of treated cases show that although the improvement in the dentition, there is a tendency to return toward the original malocclusion many years posttreatment.(Bondemark et al., 2007; Uhde; Sadowsky; BeGole, 1983) They also report that irregularity increases are slightly greater in patients treated with mandibular premolars extractions and in patients followed up over longer periods of time.(Swidi; Griffin; Buschang, 2019)

Extraction in orthodontics has remained a subject of controversial debates and speculations over time.(Rinchuse et al., 2014) In the early 1900's, Angle believed that if bone could be grown after the teeth were moved off their bony bases, the proper function of the dentition could maintain teeth in their correct positions, reaching long-term stability.(Angle, 1907) However, by the 1930's orthodontists were beginning to notice relapse. Charles H. Tweed, concerned with dental protrusions and unsatisfactory facial esthetics, started to begin extracting 4 premolars in certain patients after initially following Angle´s nonextraction dogma.(Wahl, 2005) His criterion for facial balance was the final position of the mandibular central incisors. Premolar extraction to permit alignment of crowded teeth has been an accepted procedure for decades and continues to be a common treatment modality for patients with crowded arches.(Erdinc; Nanda; Isiksal, 2006) Because of changing concepts of facial soft-

tissue profile esthetics and late growth changes, the trend in orthodontics has been toward nonextraction treatment.(Dardengo Cde; Fernandes; Capelli Junior, 2016; Erdinc; Nanda; Isiksal, 2006) Dardengo et al.(Dardengo Cde; Fernandes; Capelli Junior, 2016) stated that the frequency of tooth extraction over a period of 32 years decreased by approximately 20%. But, teeth extraction for orthodontic purposes are still well indicated in many cases.

There is a lack in the literature regarding what kind of treatment will lead to a major stability and what are the dental arch dimension changes when comparing extraction and nonextraction treatments in the long-term. Most of the follow up studies focused on morphologic changes in the mandibular arch evaluating only patients treated nonextraction(Freitas et al., 2004; Glenn; Sinclair; Alexander, 1987; Sadowsky et al., 1994; Weinberg; Sadowsky, 1996) or with extraction of pre-molars(Dyer; Vaden; Harris, 2012; Freitas et al., 2006; Little; Riedel; Artun, 1988; Little; Riedel; Engst, 1990; Little; Wallen; Riedel, 1981). Besides that, it was extensively previously demonstrated in the orthodontic literature that the great majority of the long-term studies is focused in the functional and esthetic parameters and some kind of deviations from the normal. Recently, researches changed their focus toward the patient perspective of the orthodontic treatment and their correlated satisfaction and quality of life.(Pacheco-Pereira et al., 2015) There is no known study comparing the maxillary and mandibular crowding and dental arch dimensions' relapse, patient satisfaction as well as the relapse evaluated with the PAR index and ABO OGS between extraction and nonextraction treatments more than 35 years postretention.

The objective of this study is to test the null hypothesis that there is no difference regarding crowding and dental arch dimensions relapse, patient satisfaction, as well as to compare the outcomes and the long-term occlusal stability between patients treated with and without extractions using the PAR and OGS indexes after 35 years postretention.

4 FINAL CONSIDERATIONS

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There was no difference in the amount of relapse of anterior crowding in cases treated with and without premolar extraction in long-term. The percentage of maxillary anterior crowding relapse was similar in both groups; 36.04% for the nonextraction group and 29.13% in the extraction group. However, the percentage of relapse of mandibular anterior crowding was higher in the nonextraction (84.46%) than in the extraction group (44.66%). There was no difference in the long-term relapse of transversal arch dimensions in cases treated with and without extractions. Mandibular arch perimeter showed more decrease in the long-term in extraction cases.

PAR index improved with treatment and PAR and OGS indexes showed significant increase at the long-term in both groups. Alignment, buccolingual inclination and occlusal relationship worsened over time, while marginal ridges, occlusal and interproximal contacts improved at long-term stage. The nonextraction group showed more occlusal relapse than the extraction group regarding OGS Index, but patient satisfaction was similar in both groups.

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APPENDIXES

APPENDIXES

APPENDIX A – Declaration of exclusive use of the article 1 in thesis.

DECLARATION OF EXCLUSIVE USE OF THE ARTICLE IN THESIS

We hereby declare that we are aware of the article "Long-term comparison of anterior crowding and dental arch dimensions relapse in cases treated with and without extractions" will be included in thesis of the graduate student Paula Patricia Cotrin da Silva and may not be used in other works of Graduate Programs at the Bauru Dental School, University of São Paulo.

Bauru, February 28th of 2020.

Paula Patricia Cotrin da Silva

Karina Maria Salvatore de Freitas

Marcos Roberto de Freitas

APPENDIX B - Declaration of exclusive use of the article 2 in thesis.

DECLARATION OF EXCLUSIVE USE OF THE ARTICLE IN THESIS

We hereby declare that we are aware of the article "TREATMENT OUTCOMES, LONG-TERM COMPARISON OF OCCLUSAL RELAPSE AND PATIENT SATISFACTION IN CASES TREATED WITH AND WITHOUT EXTRACTIONS" will be included in thesis of the graduate student Paula Patrícia Cotrin da Silva and may not be used in other works of Graduate Programs at the Bauru Dental School, University of São Paulo.

Bauru, February 28th of 2020.

Paula Patrícia Cotrin da Silva

Karina Maria Salvatore de Freitas

Marcos Roberto de Freitas

ANNEXES

ANNEXES

ANNEX A – Research Institutional Board approval, protocol number 71629217.5.0000.5417.

USP - FACULDADE DE ODONTOLOGIA DE BAURU DA USP

PlataForma Brasil

PARECER CONSUBSTANCIADO DO CEP

DADOS DA EMENDA

Título da Pesquisa: Comparação da recidiva oclusal em casos com e sem extrações de pré-molares em longo prazo.
Pesquisador: PAULA PATRICIA COTRIN DA SILVA
Área Temática:
Versão: 3
CAAE: 71629217.5.0000.5417
Instituição Proponente: Universidade de Sao Paulo
Patrocinador Principal: Financiamento Proprio

DADOS DO PARECER

Número do Parecer: 3.834.763

Apresentação do Projeto:
Os pesquisadores apresentam uma emenda da pesquisa para:
1 - alteração do título
2 - aumentar a amostra, sem alteração da metodologia.

Objetivo da Pesquisa:
Apresentação da emenda da pesquisa.

Avaliação dos Riscos e Benefícios:
não se aplica.

Comentários e Considerações sobre a Pesquisa:
O item 1-Mudança do título do projeto que passará a se intitular: "Comparação da recidiva oclusal de casos com e sem extrações de pré-molares em longo prazo".
O item 2-Inclusão de 17 indivíduos a mais na amostra do que o planejado no projeto.
Na busca pelos pacientes não foi possível encontrar pacientes portando contenção fixa inferior após 15 anos de tratamento, e tendo em vista a disponibilidade de pacientes já tratados com ou sem extrações, decidimos por comparar a recidiva oclusal entre os 2 grupos, sem alteração da metodologia. Como a busca resultou em mais pacientes dispostos a participar, aumentamos o número de participantes, e mais uma vez salientando que não houve alteração na metodologia, e

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sim apenas no que avaliamos. Refiero que, assim como descrito no projeto, os dados destes 17 individuos também foram conseguidos de maneira retrospectiva nos arquivos de documentação da disciplina de Ortodontia FOB-USP, respeitando-se o sigilo dos nomes e dados pessoais dos pacientes em todos as etapas da pesquisa.

O n final será de 57 individuos com má oclusão inicial de Classe I ou Classe II de Angle, que foram previamente tratados ortodonticamente, com ou sem extrações. Todos os pacientes da amostra serão leucodermas.

Considerações sobre os Termos de apresentação obrigatória:
Idem acima

Conclusões ou Pendências e Lista de inadequações:
Aprovado.

Considerações Finais a critério do CEP:
A emenda apresentada pelo(a) pesquisador(a) foi considerada APROVADA na reunião ordinária do CEP de 05/02/2020, 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_1499276_E1.pdf	17/01/2020 14:11:48		Aceito
Folha de Rosto	folhaderosto_emenda.pdf	17/01/2020 14:10:48	PAULA PATRICIA COTRIN DA SILVA	Aceito
Outros	Carta_de_Encaminhamento_Emenda_Paula.doc	17/01/2020 14:08:37	PAULA PATRICIA COTRIN DA SILVA	Aceito
Projeto Detalhado / Brochura Investigador	projeto_paula_emenda.docx	17/01/2020 14:00:31	PAULA PATRICIA COTRIN DA SILVA	Aceito

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Continuação do Parecer: 3.934.783

TCLE / Termos de Assentimento / Justificativa de Ausência	TermoConsentimentoLivreEsclarecido2.pdf	31/08/2017 16:48:13	Ana Lúcia Pompéia Fraga de Almeida	Aceito
Recurso Anexado pelo Pesquisador	respostaparecer2223054.pdf	18/08/2017 10:39:29	PAULA PATRICIA COTRIN DA SILVA	Aceito
Declaração de Pesquisadores	QuestionarioTecnicoPesquisador_rec.pdf	18/08/2017 10:38:57	PAULA PATRICIA COTRIN DA SILVA	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TermoConsentimentoLivreEsclarecido_rec.pdf	18/08/2017 10:36:17	PAULA PATRICIA COTRIN DA SILVA	Aceito
Declaração de Pesquisadores	declaracao_compromisso_pesquisador.pdf	17/07/2017 21:36:37	PAULA PATRICIA COTRIN DA SILVA	Aceito
Declaração de Instituição e Infraestrutura	paula_carta_de_encaminhamento.pdf	17/07/2017 21:36:03	PAULA PATRICIA COTRIN DA SILVA	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

BAURU, 12 de Fevereiro de 2020

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

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ANNEX B – Guidelines for AJO-DO submissions: Original Article

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

ELSEVIER

AUTHOR INFORMATION PACK

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DESCRIPTION

Published for more than 100 years, the *American Journal of Orthodontics and Dentofacial Orthopedics* remains the leading **orthodontic** resource. It is the official publication 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. Each month its readers have access to original peer-reviewed articles that examine all phases of **orthodontic treatment**. Illustrated throughout, the publication includes tables, photos (many in full color), and statistical data. Coverage includes successful diagnostic procedures, imaging techniques, bracket and archwire materials, extraction and impaction concerns, orthognathic surgery, TMJ disorders, removable appliances, and adult therapy.

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ABSTRACTING AND INDEXING

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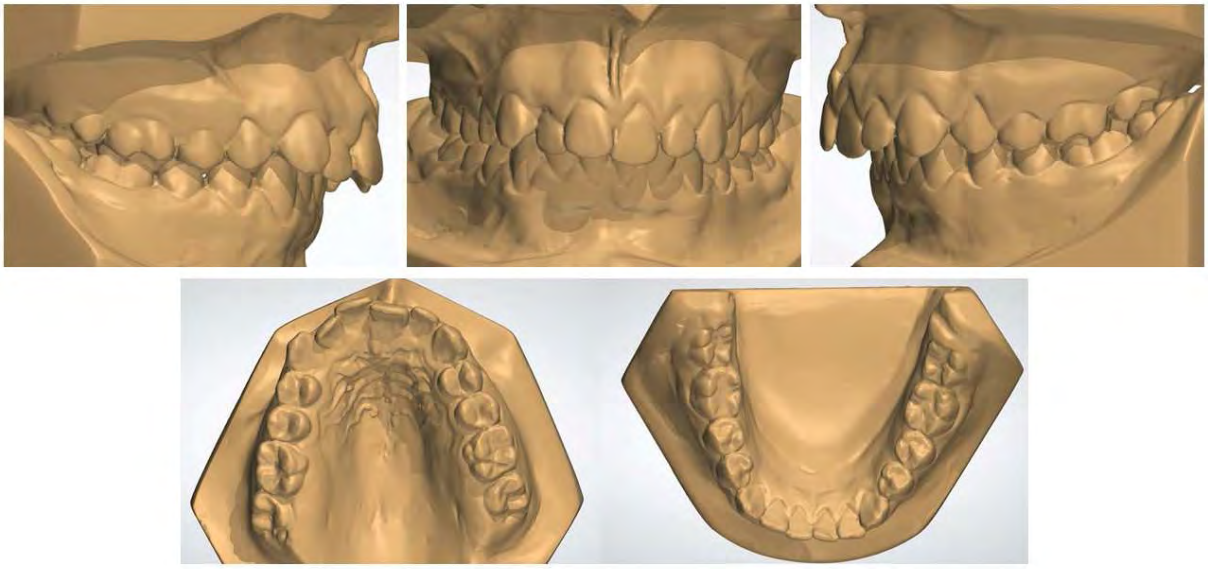
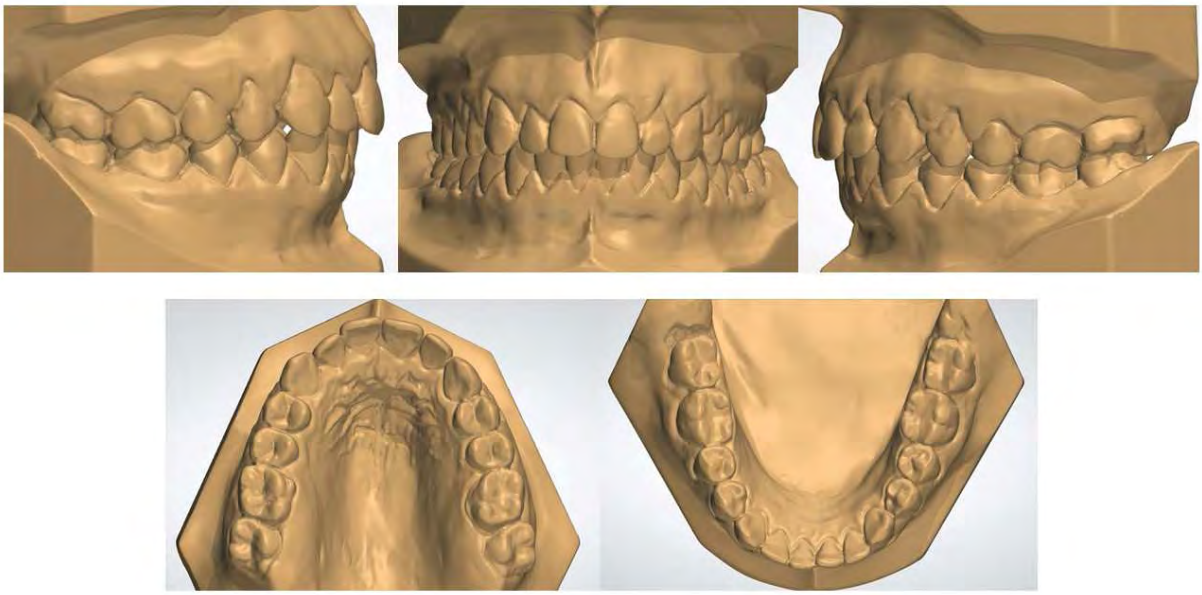
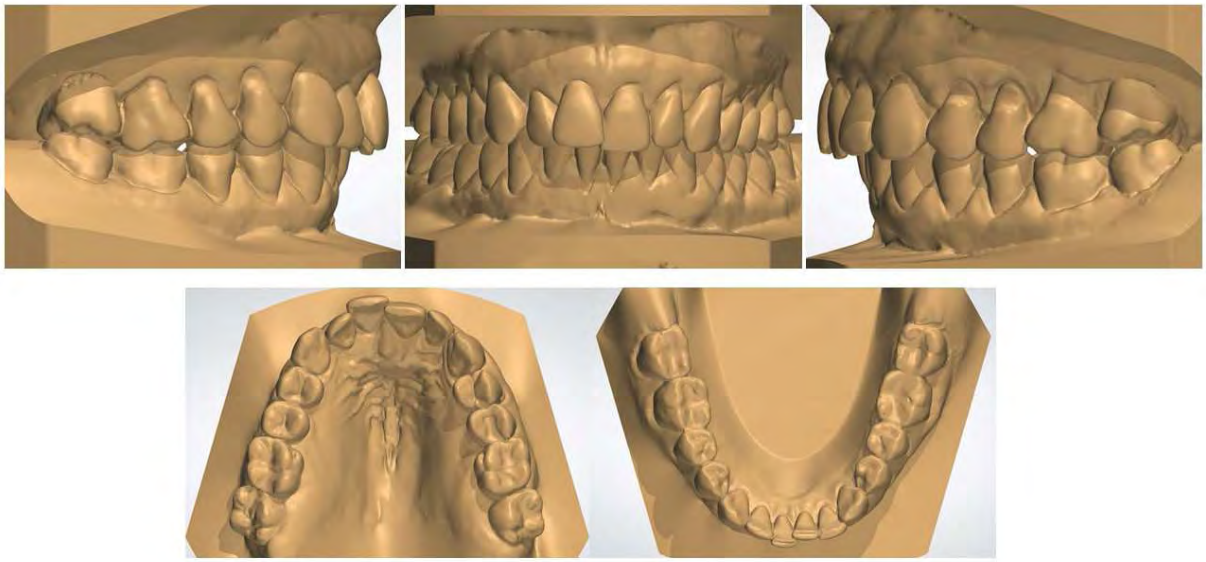
ANNEX C – Nonextraction patient at pretreatment, posttreatment and 40 years follow up



Pretreatment



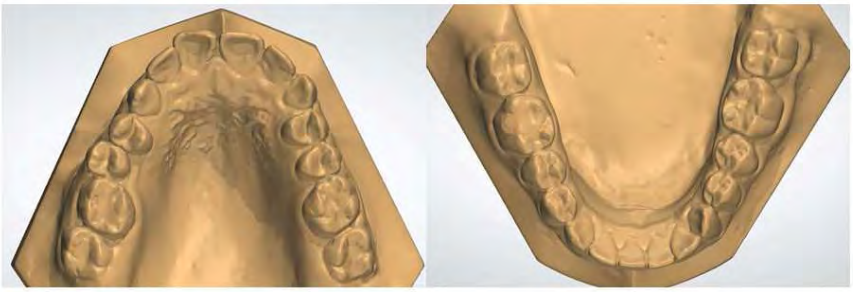
Posttreatment



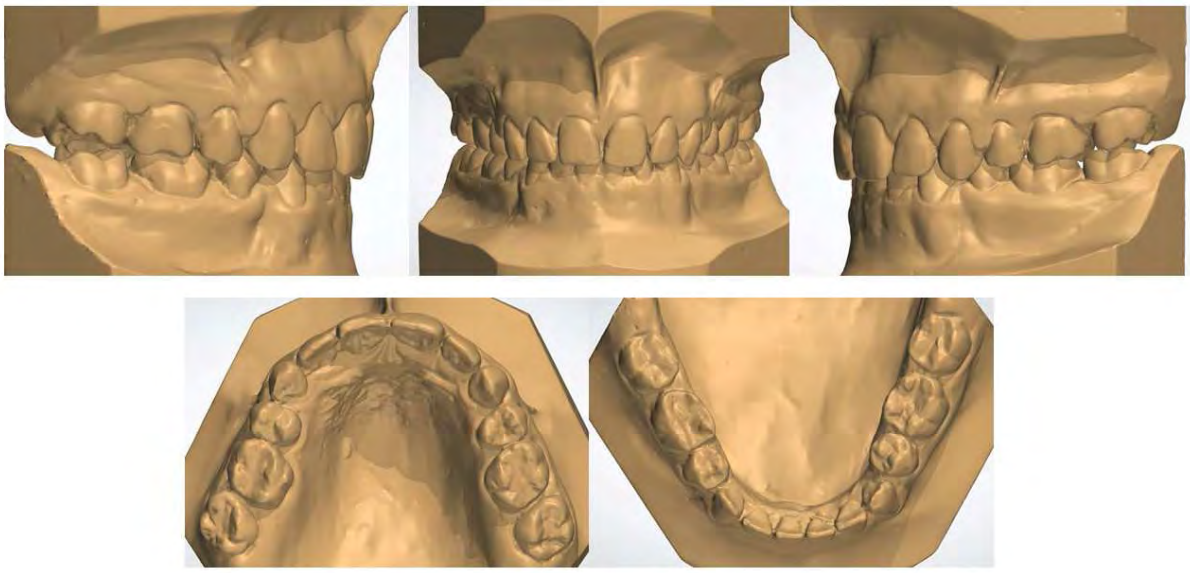
40 years follow up

40 years follow up

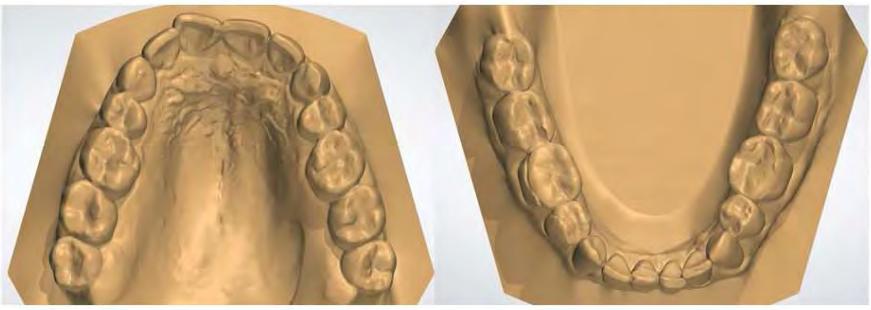
ANNEX D – Extraction patient at pretreatment, posttreatment and 43 years follow up



Pretreatment



Posttreatment



43 years follow up

43 years follow up