UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ODONTOLOGIA DE BAURU

PEDRO GRAZIANI OLÍMPIO PEREIRA

Profile and smile attractiveness after conventional orthognathic three-phase surgery treatment and with the surgery-first approach

Atratividade do perfil e do sorriso após cirurgia ortognática convencional de três fases e com cirurgia ortognática de benefício antecipado

BAURU
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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. Marcos Roberto de Freitas

BAURU

2022

Pereira, Pedro Graziani Olímpio
Profile and smile attractiveness after conventional orthognathic three-phase surgery treatment and with the surgery-first approach. – Bauru, 2022
132 p. : il. ; 31 cm.

Tese (Doutorado) -- Faculdade de Odontologia de Bauru, Universidade de São Paulo, 2020.

Orientador: Prof. Dr. Marcos Roberto de Freitas

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Comitê de Ética da FOB-USP
CAAE: 51458521.6.0000.5417
Parecer nº: 5.054.066
Data: 6/10/2021

ERRATA

FOLHA DE APROVAÇÃO

DEDICATÓRIA

Um sonho que perdura desde que finalizei minha especialização em Brasília com incentivo do Professor Dr. Carlos Henrique Guimarães Júnior. Essa é a realização de um sonho, uma vitória pessoal e da minha família. Deus, minha família e meu trabalho são as coisas mais importantes da minha vida, mas grande parte da nossa vida vivemos no trabalho, e eu sempre essa frase de Steve Jobs para alcançar meus sonhos profissionais: “Seu trabalho vai preencher uma parte grande da sua vida, e a única maneira de ficar realmente satisfeito é fazer o que você acredita ser um ótimo trabalho. E a única maneira de fazer um excelente trabalho é amar o que você faz.” E eu amo a Ortodontia! Por isso, dedico este trabalho:

A primeira “pessoa” que dedico este trabalho não poderia deixar de ser o criador do Universo **DEUS**, o único capaz de realmente tornar coisas impossíveis e torna-las coisas reais. Depois à minha esposa **Polyanna Pereira** e meu maior presente de Deus, meu filho **Pietro**, que batalhou comigo para que esse sonho fosse possível. Foram muitas idas e vindas, momentos de ausência como pai, esposo e líder de um lar. Não menos importante, meus pais **Pedro e Glória**, que renunciaram a seus próprios sonhos para tornar os meus sonhos e do meu irmão Tito de nos tornar ortodontista e médico, respectivamente.

A toda minha equipe da família Graziani Odontologia, sem eles eu não teria tido essa oportunidade.

AGRADECIMENTOS

Obrigada **Deus**... “Talvez não tenha conseguido fazer o melhor, mas lutei para que o melhor fosse feito. Não sou o que deveria ser, mas Graças a Deus, não sou o que era antes”. (Marthin Luther King)

À minha amada esposa **Polyanna**, minha companheira de vida, obrigada pelo incentivo, pelo apoio, torcida, por ouvir minhas reclamações, por estar sempre ao meu lado, me amando, não deixando que eu desistisse, enxugando minhas lágrimas, sempre perguntando as coisas mesmo sem entender nada, tentando me consolar nos períodos de maior desânimo. Obrigada pelas orações!

Ao meu filhão **Pietro**, uma criança muito amável e que me ama incondicionalmente, mesmo eu sendo um pai diferente da “matrix”. Ele me admira, se inspira em mim e me respeita. Sempre diz que me ama e sente orgulho quando dizem que ele se parece comigo. Obrigado filho, papai está aqui para o que der e vier!

Aos meus pais **Pedro Olímpio Pereira** “in memoriam” e **Glória Ilma Barbacena** por renunciarem muitos de seus sonhos para formar eu e meu irmão Tito em odontologia e medicina.

À minha equipe da clínica Graziani Odontologia por ouvir minhas angústias, organizar minha agenda, enfim, organizar minha vida para que isso fosse possível.

Ao meu cadista **Alef Meireles** por passar alguns finais de semana desenhado e renderizando ideias para o projeto.

À nossa gerente **Lana** e gerente de RH **Rafaela** por me pouparem de diversos trabalhos que me pouparam tempo para me dedicar a esse projeto.

Às ortodontistas que tiveram comigo nessa caminhada, Dra. **Paula Cardoso** e especialmente à Dra. **Demi Dahás,** que foi uma grande parceira desde que chegou à nossa equipe.

Ao **Prof. Dr. Guilherme Janson** “in memoriam” por ter a mente aberta e me proporcionar a oportunidade de pesquisar dúvidas sobre minhas percepções clínicas da minha própria linha de pesquisa e fortalecer as evidências científicas das minhas

inquietações inerentes a minha prática. Enfim, faltam palavras para agradecer seus ensinamentos em pesquisa e como educador.

Ao professor e orientador **Prof. Dr. Marcos Freitas** por me adotar em um momento difícil ´de perda e de dor para todos da Faculdade de Odontologia de Bauru.

À um anjo que Deus enviou na minha vida, a professora e orientadora **Dra. Karina Freitas**, parte fundamental deste trabalho. Obrigado por sua tranquilidade, doçura e paciência comigo. Nos encontramos na vida em um momento conturbado, e eu sinceramente me encantei pelo fato dela tornar coisas que pareciam complexas em situações simples.

À **Prof. Daniela Garib,** que além de seus ensinamentos clínicos e científicos, me ensinou que é possível ser assertivo e ao mesmo tempo suave.

Ao **Prof. Dr. José Fernando Castanha Henriques**, por abrir a oportunidade de poder cursar o Doutorado na Faculdade de Odontologia de Bauru.

Ao **Prof. Dr. Carlos Henrique Guimarães Júnior**, que desde a especialização viu em mim o potencial de realizar o mestrado e/ou doutorado na Faculdade de Odontologia de Bauru. Se Deus não o enviasse em minha vida, muito provavelmente eu teria desistido.

À Dra. **Wilana Moura** que Deus colocou em minha vida para também ser um guia para entrar no Doutorado da FOB-USP. Através dela publicamos um artigo no AJODO, que nos permitiu ser capa deste importante periódico, e foi um ponto chave para que o Dr. Guilherme Janson tivesse me escolhido como orientado.

À Dra. **Paula Cotrin** por sua gentileza em tirar dúvidas e me ensinar a mensurar o Índice PAR e OGS.

Ao **Dr. Arón Aliaga-Del Castillo** por me co-orientar em vários momentos onde eu me encontrava perdido com a minha pesquisa.

Aos meus queridos professores da especialização, Professor Ms. **Marden Bastos** e ao **Dr. An Tien Li**. Os primeiros a acreditarem em mim e a me fazer entender que a Ortodontia é ciência e arte, que exige dedicação e treinamento de habilidades intelectuais e manuais. Obrigada por todos os ensinamentos, dicas e tempo compartilhados comigo!

Agradeço muito ao **Professor Marcos Janson** e ao **Dr. Eduardo Sant'ana** por me cederem a amostra de cirurgia convencional. Especialmente, ao Professor Marcos Janson, uma pessoa especial na minha formação como ortodontista, que me deu a

honra de pesquisar em parceria com ele. Também agradeço o carinho com que me recebia em sua clínica por incontáveis vezes. À Karina Ducatti colaboradora do **Templo de Jedi**, que por muitas vezes me acolheu em momentos difíceis, um anjo de luz.

Ao meu mentor em cirurgia Ortognática de Benefício Antecipado e tratamento da Apneia Obstrutiva do Sono **Professor Dr. Jorge Faber.** Uma pessoa especial, vanguardista e ortodontista com qualidades excepcionalmente distintas. Simplesmente um visionário, um outlier da Ortodontia brasileira.

À mestranda **Gabriela Janson** pela parceria durante incansáveis horas de estudo e pela dedicação, simpatia e simplicidade de sempre.

Ao coordenador do meu mestrado **Professor Dr. Jurandir Barbosa** pelos ensinamentos clínicos e iniciação científica.

Com muito carinho, agradeço a minha turma incrível de doutorado: **Cinthya, Cristina, Gabriela Natsumeda, José Pelayo, Maria Pia, Marcelo Valério, Olga Maranhão, Rodrigo Naveda, Silvio Bellini, Marcelão e Luciana**. Foram 3 intensos anos ao lado de vocês. Obrigada pela acolhida e por todo o aprendizado! “E pela lei natural dos encontros, eu deixo e recebo ou tanto...” Cada um ficará marcado na minha vida para sempre. E, ao falar desta turma incrível, não poderia deixar de agradecer em especial 5 pessoas: meu parceiro de artigos **Silvio Bellini**, a pessoa mais querida da sala **Cristina Bastiani** e parceira do cafezinho da cantina meu grande parceiro **Marcelo Soares Corrêa**, minha parceira de metanálise **Luciana Muniz** e ao colega **Marcelo Valério** por me ajudar a fazer os projetos.

Agradeço aos professores do departamento de Ortodontia da FOB: **Dr. Arnaldo Pinzan** e **Dr. Renato Almeida**. Obrigada pelos ensinamentos e pela oportunidade de partilhar um período da minha vida com a história viva da ortodontia mundial e brasileira.

Agradeço também aos funcionários do departamento de Ortodontia: **Wagner, Sérgio, Vera e Cleo**. Um agradecimento especial à Verinha e Cleo que sempre, pacientemente, me ensinaram como proceder tanto em eventos burocráticos como em procedimentos na clínica.

Ao **Daniel (Bonné)** pela prontidão em ajudar com os computadores. Sua ajuda foi essencial.

Às funcionárias da **secretaria de pós-graduação**: Leila e Letícia pela excelente ajuda com a parte burocrática deste doutorado.

Aos **funcionários da esterilização**, que sempre me atenderam muito bem durante o período de atendimento em clínicas.

A todos os **funcionários da FOB** de maneira geral, muito obrigada.

À **Faculdade de Odontologia de Bauru**, Universidade de São Paulo, na pessoa do diretor Prof. Dr. Carlos Ferreira dos Santos; e do vice-diretor Profa. Dra. Marilia Afonso Rabelo Buzalaf e a **todos os seus funcionários**.

À **CAPES** pelo apoio financeiro e pelo incentivo ao desenvolvimento de pesquisa e ciência no Brasil. O presente trabalho foi realizado com o apoio da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Código de Financiamento 001.

A todos que colaboraram de forma direta ou indireta na realização e finalização desse trabalho e que, porventura, não foram mencionados

E, por último, agradeço à parte fundamental deste trabalho: **todos os pacientes que se voluntariaram a participar da nossa pesquisa**. A todos vocês, a minha mais profunda gratidão!

“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

Profile and smile attractiveness after conventional orthognathic three-phase surgery treatment and with the surgery-first approach

Objective: This study aimed to compare the attractiveness of the profile and smile in patients treated with Conventional Three-phase Orthognathic Surgery (CTOS) and Surgery-First Approach (SFA). **Material and methods:** The sample to evaluate the attractiveness of the profile comprised 46 patients that were divided into 2 groups: Group 1: 25 patients treated with SFA with mean age of 31.05 years (SD 7.99); Group 2: 21 patients treated with CTOS with mean age of 28.81 years (SD 9.24). The sample to evaluate the attractiveness of smile comprised 40 patients that were divided into 2 groups: Group 1: 25 patients treated with SFA with mean age of 31.05 years (SD 7.99); Group 2: 15 patients treated with CTOS with mean age of 25.88 years (SD 7.67). Medical records and digital dental models or dental casts of patients treated orthodontic-surgically by SFA and by CTOS were selected retrospectively from private clinics of Belém and Bauru, Brazil. Pretreatment and posttreatment silhouettes of both groups were performed by transferring the cephalometric tracings from Dolphin software to Adobe Photoshop 2020. Pretreatment and posttreatment smile photographs were cropped in a dimension of 21 x 12.4 cm and converted to black and white after removing the hair face and blemishes to reduce the number of confusing variables. The participants of each modality were randomized in Excel in T1 and T2 for both variables. Then a questionnaire separated for each variable (profile and smile) with Informed Consent Form, the records of the evaluators, the randomized silhouettes and smile in T1 and T2 using a scale in the form of a 10-point grading was sent to WhatsApp Messenger to laypeople, orthodontists, and maxillofacial surgeons. Intergroup comparability of initial age, treatment time, initial PAR index, and cephalometric measurements was performed with independent t tests and sex distribution and type of malocclusion was performed with chi-square test. The score of the initial and final profile and smile attractiveness between the three groups of evaluators was compared with one-way ANOVA and Tukey test. A backward multiple linear regression was used to evaluate if the %PAR and OGS are predictors in the final profile attractiveness. The association between the surgical modalities and the OGS, %PAR and final smile attractiveness were verified with Spearman correlation test. **Results:** In both groups, SFA and CTOS, there was an improvement of profile and

smile attractiveness with treatment. Before treatment, the profile of the SFA presented no difference when compared with the CTOS group. Before treatment, the smile of the CTOS group was significantly less attractive than the SFA group. At the final stage, the SFA group presented a more attractive and greater improvement of the profile than the CTOS group. At the final stage, the SFA group presented a more attractive smile than the CTOS group. The %PAR is a predictor in the attractiveness of the final profile and the OGS has a strong and positive correlation with the surgical modalities. **Conclusions:** In this study the SFA show better results in attractiveness of smile and profile with better quality of finishing than COS group. SFA has become a good alternative for patients, maxillofacial surgeons and orthodontists with shorter treatment time.

Keywords: Malocclusion. Orthognathic surgery. Esthetic.

RESUMO

Atratividade do perfil e do sorriso após o tratamento com cirurgia convencional de três fases e com benefício antecipado

Objetivo: O objetivo deste estudo foi comparar a atratividade do perfil e do sorriso em pacientes tratados com Cirurgia Ortognática Convencional de Três Fases (COCTF) e Cirurgia Ortognática de benefício antecipado (COBA). **Material e métodos**: A amostra para atratividade do perfil incluiu 46 pacientes que foram divididos em 2 grupos: Grupo 1: 25 pacientes tratados com COBA com média de 31,05 (7,99) anos; Grupo 2: 21 pacientes tratados com COCTF com média de 28,81 (9,24) anos. A amostra para avaliação da atratividade do sorriso foi composta por 40 pacientes que foram divididos em 2 grupos: Grupo 1: 25 pacientes tratados com SFA com média de 31,05 (7,99) anos; Grupo 2: 15 pacientes tratados com CTOS com média de 25,88 (7,67) anos. Os prontuários e modelos dentários digitais ou físicos de pacientes pela COBA e pela COCTF foram selecionados retrospectivamente em clínicas privadas de Belém e Bauru, Brasil. O pré-tratamento e o pós-tratamento da silhueta de ambos os grupos foram realizados por transferência de traçados cefalométricos do software Dolphin para Adobe Photoshop 2020. O pré-tratamento e o pós-tratamento dos sorrisos foram recortados em uma dimensão de 21 x 12,4 cm e convertidos para preto e branco para reduzir o número de variáveis de confundimento. Os participantes de cada modalidade foram randomizados no Excel em T1 e T2 para ambas as variáveis. Em seguida, foi enviado ao WhatsApp Messenger um questionário separado para cada variável (perfil e sorriso) para avaliadores leigos, ortodontistas e cirurgiões bucomaxilofacial, com o Termo de Consentimento Livre e Esclarecido, os dados dos avaliadores, as silhuetas e os sorrisos randomizados, o sorriso e a silhueta em T1 e T2 utilizando a escala na forma de pontuação de 10 pontos. A comparabilidade intergrupos de idade inicial, tempo de tratamento, índice PAR inicial e medidas cefalométricas foram realizadas com testes t independentes e distribuição de sexo e tipo de má oclusão foi realizada com teste de qui-quadrado. A pontuação do perfil inicial e final e atratividade do sorriso entre os três grupos de avaliadores foi comparada com ANOVA one-way e teste de Tukey. Uma regressão linar múltipla foi usada para avaliar se a % PAR e o OGS são preditores da atratividade final do perfil. Para avaliar a associação entre as modalidades cirúrgicas com as variáveis OGS,% PAR e atratividade final do sorriso foi utilizada a correlação de Spearman. **Resultados**: Antes do tratamento, o perfil do

grupo COBA não apresentou diferença do grupo COCTF. Antes do tratamento, o sorriso do grupo COCTF era significativamente menos atraente do que o grupo SFA. Na fase final, o grupo COBA apresentou uma melhora de perfil mais atraente e maior do que o grupo COCTF. Na fase final, o grupo SFA apresentou um sorriso mais atraente do que o grupo COCTF. A regressão linear múltipla mostrou que a %PAR é um preditor na atratividade final do perfil. A qualidade da finalização (OGS) tem correlação forte e positiva com as modalidades cirúrgicas. **Conclusões**: Neste estudo a COBA apresentou melhores resultados na atratividade do sorriso e do perfil com melhor qualidade da finalização ortodôntica do que a COCTF. A COBA tornou-se uma boa alternativa para pacientes, cirurgiões bucomaxilofaciais e ortodontistas com menor tempo de tratamento.

Palavras-chave: Maloclusão. Cirurgia ortognática. Estética.

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LIST OF ABREVIATIONS AND ACRONYMS

SFA	Surgery-First Approach
CTOS	Conventinal Three-Phase Ortohognathic Surgery
MPOP	Minimal Presurgical Orthodontics Preparation
T1	Pretreatment
T2	Posttreatment
T2 – T1	Treatment changes
PAR	Peer Assessment Rating
NHP	Natural Head Position
FP	Frankfurt Plane
RAP	Rapid Acceleratory Phenomenon

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1 INTRODUCTION

1 INTRODUCTION

The first case of orthognathic surgery without prior orthodontics was reported in 1944 by Dingman.(Dingman and Surgery 1944)In the 1960s, surgeons rarely depended on orthodontic-surgical preparation and performed orthognathic surgery without prior orthodontic treatment or even after the patient had received orthodontic treatment.(Poulton, Taylor et al. 1963) Due to below expectations results, and to the fact that only the mandibular setback was performed, it was observed that the amount of horizontal overlap was insufficient to correct the bone discrepancy.(Poulton, Taylor et al. 1963)

Bell et al. 1973 reported the need for a minimal orthodontic treatment for surgically correcting cases of maxillary protrusion and bimaxillary protrusion through segmentation of the maxilla and mandible and advancing the chin.(Bell and Dann III 1973)

Since 1976, Worms et al.(WoRMs, ISAACSON et al. 1976) expanded the concept of performing orthodontic treatment before surgery for all types of dentofacial deformities, emphasizing that orthodontic treatment should be performed before surgery to eliminate all dental compensations and allow better positioning of the bone bases.(WoRMs, ISAACSON et al. 1976) Thus, the treatment before orthognathic surgery has become a standard procedure among all surgery teams around the world.(WoRMs, ISAACSON et al. 1976, Huang, Hsu et al. 2014)

Even with orthodontic preparation before orthognathic surgery having become the model of choice among teams of orthodontists and maxillofacial surgeons until the end of the first decade of the 21st century, other authors have highlighted the possibility of performing surgery before orthodontics.(Epker and Fish 1977, Behrman and Behrman 1988, Brachvogel, Berten et al. 1991, Lee 1994)

Epker and Fish 1977,(Epker and Fish 1977) demonstrated orthognathic surgery before orthodontics or even with minimal orthodontic alignment and leveling in the treatment of hyperdivergent patients with anterior open bite.(Epker and Fish 1977)

Behrman and Behrman 1988, reported the benefits of performing surgery before orthodontics, as the economic, social and psychological demands of adult patients are different from that of young patients.(Behrman and Behrman, 1988)

Brachvogel et al. 1991(Brachvogel, Berten et al. 1991) proposed surgery before orthodontics, because after the correction of the bone bases, the correction movement for Class I is the same as a compensatory treatment, in addition, small relapses can be easily corrected by the orthodontist himself.(Brachvogel, Berten et al. 1991)

Lee 1994,(Lee 1994) demonstrated the advantages of performing the correction of bone bases and soft tissues as quickly as possible, considering that it is easy to perform the orthodontic movement on a face with the bone bases, musculature and soft tissues in balance.(Lee 1994)

However, the major paradigm shift occurred from the article published by Nagasaka et al. in 2009.(Nagasaka, Sugawara et al. 2009) The main "insight" of those authors was the insertion of miniplates SAS (Skeletal Anchorage System)(Sugawara, Umemori et al. 1998, Umemori, Sugawara et al. 1999) to eliminate dental compensations after the correct relationship of the bone bases, and this new concept allowed the elimination of the surgery limitations before orthodontics that was heavily criticized by the surgery and orthodontics teams.(Sugawara, Nagasaka et al. 2018) From that period onwards, the Surgery-First Approach orthognathic surgery allowed a new possibility for patients with dentofacial deformities, orthodontists and maxillofacial surgeons.(Sugawara, Nagasaka et al. 2018)

At Tohoku University, Sugawara et al. reported a rate of 91.7% of surgical cases treated with the Surgery-First Approach and only 8.7% are performed conventionally, among the cases of early benefit, the percentage of cases treated with surgery in only one of the jaws is 76.3% and bimaxillary in 23.7%.(Sugawara, Nagasaka et al. 2018) The vast majority of deformities are class III (85.5%), followed by class II deformities (9.1%) and finally class I deformities (5.4%).(Sugawara, Nagasaka et al. 2018) Hernández-Alfaro et al.(Hernández-Alfaro and Guijarro-Martínez 2014) reported that the percentage of cases treated with the SFA is performed in only 18,8% of orthosurgical patients.(Hernández-Alfaro and Guijarro-Martínez 2014)

Although most patients with dentofacial deformities can be treated with SFA, the most indicated cases are patients with mandibular prognathism associated or not to the mandibular deficiency, with an interincisal angle close to normal, mild to moderate crowding and spee curve flat or slightly deepened, that is, without a big bite adjustment or also without an open bite.(Choi, Garagiola et al. 2019, Uribe, Farrell et al. 2020) In the transversal direction, there should be no cross bite or collapse when the models are handled in class I.(Liou, Chen et al. 2011, Gandedkar, Chng et al. 2016) While whereas, the least indicated would be those in need of tooth extractions, severe crowding, very open or very closed interincisal angle, and retrognathic individuals.(Choi, Garagiola et al. 2019, Uribe, Farrell et al. 2020) But the experience of the orthodontist and the maxillofacial surgeon increases the range of possibilities with this approach.(Uribe, Farrell et al. 2020)

Most articles report a shorter treatment time with the SFA when compared to Conventional Orthognathic Three-Phase Surgery (CTOS).(Hernández-Alfaro, Guijarro-Martínez et al. 2014, Huang, Hsu et al. 2014, Peiro-Guijarro, Guijarro-Martinez et al. 2016, Yang, Xiao et al. 2017, Barone, Morice et al. 2020) In addition, there are reports of improvements in the quality of life of individuals undergoing orthognathic surgery, because malocclusions with facial deformities have a negative impact on quality of life, whereas correction of these significantly increases it.(Soh and Narayanan 2013, Pachêco-Pereira, Abreu et al. 2016, Barone, Morice et al. 2020) Patients who performed ortho-surgical treatment reported increased psychological well-being and self-confidence.(Park, Choi et al. 2015, Huang, Chen et al. 2016, Feu, de Oliveira et al. 2017, Pelo, Gasparini et al. 2017, Zingler, Hakim et al. 2017)

However, SFA also has its disadvantages. Some authors have reported as disadvantages, the need for greater overcorrections of the bone bases to eliminate the dental compensations, a great “expertise” of the orthodontist and the maxillofacial surgeon, shorter interval between consultations than in the conventional approach and constant communication between the orthodontist and maxillofacial surgeon. However, the main disadvantage has been a possible percentage of recurrence with counterclockwise rotation of the jaw.(Peiro-Guijarro, Guijarro-Martinez et al. 2016, Choi, Kim et al. 2019, Uribe, Farrell et al. 2020)

The literature has shown a certain divergence on the issue of this post-surgical instability of orthognathic surgery of SFA; however, some have shown that there are no statistically significant differences.(Liao, Chiu et al. 2010, Ko, Hsu et al. 2011, Hsu, Gateno et al. 2013, Huang, Hsu et al. 2014, Park, Yang et al. 2015, Sharma, Yadav et al. 2015, Park, Sandor et al. 2016, Yang, Xiao et al. 2017, Soverina, Gasparini et al. 2019)

On the other hand, stability has been reported with less stability and anteroposterior changes in the counterclockwise direction of the pogonion and point B, which can lead to statistically significant changes in the mandible and affect the aesthetics of the facial profile.(Hsu, Gateno et al. 2013, Kim, Lee et al. 2013, Kim, Lee et al. 2014, Choi, Hwang et al. 2016, Wei, Liu et al. 2018) From this premise, there may be a difference in the results of facial profiles.

The position of the jaw has a great influence on facial esthetics,(Johnston, Hunt et al. 2005, Kuroda, Sugahara et al. 2009, Naini, Donaldson et al. 2012, Kim, Lee et al. 2014) a fact that reinforces the speculation that the attractiveness of the profile would be impaired in the SFA modality in relation to CTOS. Higher skeletal recurrence would imply less predictability of the final integumentary aspect, as well as invariably affect the intra and interarch occlusal relationship since skeletal recurrence would act against the decompensating work of the orthodontist.(Ko, Hsu et al. 2011, Hutchinson and Lee 2013, Kim, Lee et al. 2014, Akamatsu, Hanai et al. 2016, Mah, Kim et al. 2017) Thus, there would also be less predictability of the final occlusion since greater adjustments would be necessary for the arches separately so that the ideal intercuspation was achieved. The repercussion of these adjustments on the anterior teeth and overlapping would inevitably damage the final aspect of the smile as well.(Chang, Fields Jr et al. 2011, Machado, Moon et al. 2013)

However, the amount of information in the scientific literature about the attractiveness of the profile and when it comes to orthodontic-surgical approaches is extremely scarce and, in general, almost entirely restricted to the traditional protocol (CTOS). The articles that evaluated facial aesthetics, made only quantitative comparisons through cephalometric measures.(Liao, Chiu et al. 2010, Zhou, Li et al. 2016) Qualitative comparisons evaluating the attractiveness of the profile of patients treated by the only two existing protocols (CTOS and SFA) were never performed.

Therefore, despite several studies pointing to the SFA protocol as an alternative with shorter treatment time,(Hernández-Alfaro, Guijarro-Martínez et al. 2014, Choi, Lee et al. 2015, Huang and Chen 2015, Janakiraman, Feinberg et al. 2015, Park, Yang et al. 2015, Peiro-Guijarro, Guijarro-Martinez et al. 2016) and so that the patient is not exposed to the psychosocial cost of pre-surgical esthetic deterioration(Park, Yang et al. 2015, Huang, Chen et al. 2016, Feu, de Oliveira et al. 2017, Pelo, Gasparini et al. 2017, Zingler, Hakim et al. 2017) due to the dental decompensation required in the three-phase protocol, it is necessary to compare the final attractiveness of the profile and between both protocols.

2 ARTICLES

2 ARTICLES

The articles presented in this Thesis were written according to the American Journal of Orthodontics and Dentofacial Orthopedics instructions and guidelines for article submission (Annex D).

- **Article 1 -** Profile attractiveness after conventional orthognathic three-phase surgery treatment and with surgery-first approach.

- **Article 2 -** Smile attractiveness after conventional orthognathic three-phase surgery treatment and with surgery-first approach.

2.1 ARTICLE 1

Profile attractiveness after conventional orthognathic three-phase surgery treatment and with the surgery-first approach.

ABSTRACT

Objective: This study aimed to compare the attractiveness of the profile and smile in patients treated with Conventional Three-phase Orthognathic Surgery (CTOS) and Surgery-First Approach (SFA). **Material and methods:** The sample to evaluate the attractiveness of the profile comprised 46 patients that were divided into 2 groups: Group 1: 25 patients treated with SFA with mean age of 31.05 years (SD 7.99); Group 2: 21 patients treated with CTOS with mean age of 28.81 years (SD 9.24). Medical records and digital dental models or dental casts of patients treated orthodontically-surgically by SFA and by CTOS were selected retrospectively from private clinics of Belem and Bauru, Brazil. Pretreatment and posttreatment silhouettes of both groups were performed by transferring cephalometric tracings from Dolphin software to Adobe Photoshop 2020. The participants of each modality were randomized in Excel in T1 and T2. Then a questionnaire with Informed Consent Form, the records of the evaluators, the randomized silhouettes in T1 and T2 using a scale in the form of a 10-point grading was sent to WhatsApp Messenger to laypeople, orthodontists, and maxillofacial surgeons. Intergroup comparability of initial age, treatment time, initial PAR index, and cephalometric measurements was performed with independent t tests and sex distribution and type of malocclusion was performed with chi-square test. The score of the initial and final profile attractiveness between the three groups of evaluators was compared with one-way ANOVA and Tukey test. A backward linear regression was used to evaluate the %PAR and OGS like independent variables and the final silhouette profile like dependent variable. **Results:** In both groups, SFA and CTOS, there was an improvement of profile attractiveness with treatment. Before treatment, the profile of the SFA had no difference when compared to the CTOS group. At the final stage, the SFA group presented a more attractive and greater improvement of the profile than the CTOS group. The %PAR was a predictor of the profile attractiveness. **Conclusions:** In this study the SFA demonstrated better results in attractiveness of profile with better quality of finishing than COS group. SFA has become a good alternative for patients, maxillofacial surgeons and orthodontists with shorter treatment time.

Keywords: Malocclusion. Orthognathic surgery. Esthetic.

INTRODUCTION

The standard of beauty seems to be a factor of great impact on society, as the attractiveness of the face and the beauty parameters is an important factor for social acceptance.[1] Patients with borderline dentofacial deformities have a higher profile than patients who only received compensatory orthodontic treatment.[2] Assuming that most severe malocclusions are associated with large-scale skeletal discrepancies, an important percentage of people require combined surgical-orthodontic treatment.[3]

Patient prototypes have been changing over the past 15 years due to factors such as minimally invasive procedures, shorter hospital stays, orthodontic and surgical software to increase patient accuracy and understanding, and new surgical approaches.[3-5] In addition to the exposure of patients and professionals on social media, such as YouTube, Instagram and Facebook, it has drawn more attention even from patients with dentofacial deformities.[5,6]

Today we have three modalities of orthognathic surgery: Conventional Three-Phase Orthognathic Surgery (CTOS), Surgery-First Approach (SFA) and Minimal Presurgical Orthodontic Preparation (MPOP).[7-11]

The surgery before or even after or without orthodontic treatment has been performed since the 60's decade, but the limitations of orthodontic mechanics, surgical techniques and planning tools determined the unsuccess of this approach.[12] For this reason, Worms et al. 1976[13] standardized the Orthodontic-First Approach to decompensate the teeth for all cases of orthognathic surgery.

Other authors continued to publish about the Surgery-First Approach (SFA),[14-17] but the most ortho-surgical teams in the world chose the orthognathic surgery that became known as Conventional Three-Phase Orthognathic Surgery (CTOS).

However, the major paradigm shift occurred from the article published by Nagasaka et al. in 2009.[18] The main "insight" of those authors was the insertion of miniplates SAS (Skeletal Anchorage System)[19,20] to eliminate dental compensations after the correct relationship of the bone bases, and this new concept allowed the elimination of the surgery limitations before orthodontics that was heavily criticized by the surgery and orthodontics teams.[8] From that period onwards, the SFA allowed a new possibility for patients with dentofacial deformities, orthodontists and maxillofacial surgeons.[21]

Although most patients with dentofacial deformities can be treated with Surgery-First Approach, the most indicated cases are patients with mandibular prognathism associated or not to the mandibular deficiency, with an interincisal angle close to normal, mild to moderate crowding and spee curve flat or slightly deepened, that is, without a big bite adjustment or also without an open bite.[22,23] In the transversal direction, there should be no cross bite or collapse when the models are handled in class I.[24,25] While whereas, the least indicated would be those in need of tooth extractions, severe crowding, very open or very closed interincisal angle, and retrognathic individuals.[22,23] But the experience of the orthodontist and the maxillofacial surgeon increases the range of possibilities with this approach.[23]

Most articles report a shorter treatment time with the SFA when compared to Conventional Orthognathic Three-Phase Surgery (CTOS).(Yang et al., 2017; Huang et al., 2014; Park et al., 2015; Hernández-Alfaro, 2014; Peiro-Guijarro et al., 2016; Barone et al., 2020) In addition, there are reports of improvements in the quality of life

of individuals undergoing orthognathic surgery, because malocclusions with facial deformities have a negative impact on quality of life, whereas correction of these significantly increases it.(Pachêco-Pereira et al., 2016; Soh, et al. 2013 ; Barone et al., 2020) Patients who performed ortho-surgical treatment reported increased psychological well-being and self-confidence.(Pelo et al., 2017; Huang et al., 2016; Park et al., 2015; Feu et al, 2017; Zingler et al., 2017)

The literature has shown a certain divergence on the issue of this post-surgical instability of orthognathic surgery of SFA; however, some have shown that there are no statistically significant differences. (Yang et al., 2017; Sharma et al., 2015; Soverina et al., 2019; Huang et al., 2014; Hsu et al., 2013; Ko et al., 2011; Park et al., 2015; Park et al. 2016; Liao et al, 2010)

On the other hand, stability has been reported with less stability and anteroposterior changes in the counterclockwise direction of the pogonion and point B, which can lead to statistically significant changes in the mandible and affect the aesthetics of the facial profile.(Hsu et al, 2013; Choi et al., 2016; Kim et al., 2014; Kim, et al.,2014; Wei et al., 2018) From this premise, there may be a difference in the results of facial profiles.

The position of the jaw has a great influence on facial esthetics,(Naini et al., 2012; Kuroda et al., 2009; Johnston et al., 2005) a fact that reinforces the speculation that the attractiveness of the profile would be impaired in the SFA modality in relation to CTOS. Higher skeletal recurrence would imply less predictability of the final integumentary aspect, as well as invariably affect the intra and interarch occlusal relationship, since skeletal recurrence would act against the decompensating work of the orthodontist(Kim et al., 2014; Hutchinson et al., 2013; Mah et al., 2017; Akamatsu et al., 2016; Ko et al., 2011). Thus, there would also be less predictability of the final occlusion since greater adjustments would be necessary in the arches separately so that the ideal intercuspation was achieved. The repercussion of these adjustments on the anterior teeth and overlapping would inevitably damage the final aspect of the smile as well. (Chang et al, 2011 ;Machado et al., 2013)

However, the amount of information in the scientific literature about the attractiveness of the profile when it comes to orthodontic-surgical approaches is extremely scarce and, in general, almost entirely restricted to the traditional protocol (CTOS). The articles that evaluated facial aesthetics, made only quantitative comparisons through cephalometric measures.(Liao et al, 2010; Zhou, et al., 2016) Qualitative comparisons evaluating the attractiveness of the profile of patients treated by the only two existing protocols (CTOS and SFA) were never performed.

Therefore, despite several studies pointing to the SFA protocol as an alternative with shorter treatment time,(Hernández-Alfaro et al., 2014 ;Park et al, 2015;Peiro-Guijarro et al., 2016; Huang et al., 2015; Janakiraman et al., 2015;Yang et al., 2017) even though this topic also has some controversy, and so that the patient is not exposed to the psychosocial cost of pre-surgical esthetic deterioration (Pelo et al., 2017; Huang et al., 2016; Park et al., 2015; Feu et al., 2017; Zingler et al., 2017) due to the dental decompensation required in the CTOS protocol, it is necessary to

compare the initial and final attractiveness of the profile and treatment time between both protocols.

OBJECTIVES

This study aimed to retrospectively evaluate the attractiveness of the profile in the pretreatment (T1), posttreatment (T2) and treatment time in patients with dentofacial deformities treated by the CTOS and SFA.

MATERIAL AND METHODS

The study was approved by the Ethics in Research Committee of Bauru Dental School, University of São Paulo, Brazil (protocol number CAAE: 51458521.6.0000.5417, decision number: 5.054.066).

Sample size calculations (patients)

The sample size calculation was based on an alpha significance level of 5% (0.05) and a beta of 20% (0.20) to achieve 80% power test to detect a minimum difference of 0.85 points with a standard deviation of 0.95 for the posttreatment profile attractiveness.[26] Thus, the sample size calculation resulted in the need for at least 21 patients in each group.[27]

Sample size calculations (evaluators)

The sample size calculation was based on an alpha significance level of 5% (0.05) and a beta of 20% (0.20) to achieve 80% power test to detect a minimum difference of 0.7 points with a standard deviation of 0.95 for the posttreatment profile attractiveness score (Mendes et al, 2019). Thus, the sample size calculation resulted in the need for at least 30 evaluators in each group.[27]

PARTICIPANTS

Eligibility Criteria

To provide greater reliability to the results that may be obtained, the medical records will be selected according to the following criteria: Complete initial and final orthodontic documentation, two-jaw surgery, absence of craniofacial anomalies, complete initial diagnosis, plaster models or 3D prints in good condition. **Exclusion criteria** consisted of patients with craniofacial anomalies or syndromes, one-jaw surgery, supernumerary and/or anomalous teeth. Consecutive patients, within the inclusion criteria, were retrospectively selected from the files of private orthodontic clinics of Bauru and Belem, Brazil, from March 2004 to December 2020. Seventy-six medical records were evaluated, forty-five were SFA modality and Thirty-one were CTOS.

The sample was divided into two groups: Group 1 consisted of 21 subjects treated with CTOS with a mean age of 28.81 (9.24), 10 were male and 11 females, 3 were Class I, 11 Class II and 7 Class III. and Group 2, composed of 25 patients treated with SFA, with mean age of 31.05 years (7.99), 7 were male and 18 females, 4 were Class I, 12 Class II and 9 Class III. All the patients received bimaxillary surgery with Lefort I in the upper jaw and bilateral sagittal split osteotomy (BSSO) in both groups

with and without genioplasty. In the SFA group, the patients did not receive any orthodontic treatment before surgery and the brackets were positioned by the same operator (P.G.O.P) a week before the surgery and the wire a day before the procedure in all cases. The ortho-surgical treatment was made by a single orthodontist (P.G.O.P) and surgeon (F.S.N.F). The orthodontic treatment begins 15 to 21 days after surgery. All the patients that were treated with SFA received four miniplates in strategics sides, depending on the biomechanics necessity and no patient remained with the final guides after surgery. Surgical stabilization was maintained with intermaxillary elastics and orthodontic miniplates. Nine of these patients were treated by lingual technique, three with Invisalign e and the others thirteen with labial multibrackets technique. The CTOS group was treated by the same orthodontist (M.J.) with twenty-six years like a specialist in Orthodontics and surgeon (E.S) with twenty-seven years like a specialist in maxillofacial surgery, and all patients were treated with labial multibrackets technique. The orthodontic treatment begins 45 days after surgery. For both groups lateral cephalograms, photography and dental casts were obtained. The groups were made compatible regarding (1) initial age, (2) treatment time, (3) distribution between the sexes, (4) malocclusion type and (5) cephalometric variables (Table 1).

Cephalometric variables.

The teleradiographs were oriented with the photographs in NHP (Natural Head Position) using a horizontal line across the C point (the most prominent point of the Cornea) and a vertical line, like described by Lundström et al. 1995 and Finn et al. 2019 (Fig 1).[28,29] All the cephalometric tracing and orientation of the head were calibrated between the operator (PGOP) and an expert (GJ). All the vertical angles between the vertical line and N'-PG in cephalometric radiograph and photography were measured with open-source Image J software with a tolerance level of 0.3° degrees. Then all the cephalometric measurements were performed on Dolphin software version 11.95 in PNC.

Profile scan and silhouettes

As the radiographs were taken in different documentation centers and different X-ray devices, the magnification factor was indicated. This varies between 6% and 9.8%, depending on which X-ray machine has been used. This correction was made using the Dolphin 11.95 program (Chatsworth, California, USA), inserting the size of the calibration rule (Ruler Length) of the image with the magnification correction. In cases where the lateral cephalograms were generated digitally using CT scans or digitized with the Sidexis 4 software in Orthophos SL 3D (Denstply Sirona, York, Pennsylvania, United States), the 1: 1 ratio will be used, without the need for correction of the magnification in Dolphin.

The teleradiographs and photographs of each patient before and after treatment were imported to Adobe Photoshop 2020 Software. The teleradiographs were oriented with the photographs in NHP (Natural Head Position) using a horizontal line across the C point (the most prominent point of the Cornea) and a vertical line like described by Lundström et al. 1995 and Finn et al. 2019 (Fig 1).[28,29] All the cephalometric tracing and orientation of the head were calibrated between the operator (PGOP) and an expert (GJ). All the vertical angles between the vertical line and N'-PG in cephalometric radiograph and photography were measured with open-source Image J software with a tolerance level of 0.3° degrees.

Pretreatment and posttreatment silhouettes of both groups were imported from Photoshop to Dolphin and performed the cephalometric tracing in PNC and then sent to Photoshop again. The drawings were delimited in the posterior region by a line tangent to the most posterior point of the condyle, inferiorly, below the cervical point, and in the superior part, just above the Glabella (Fig.2).[30-32] The same procedure was performed to the final silhouette (Fig 3). And the initial and final photographs were calibrated and compared more than one time with the silhouettes by the operator (P.G.O.P) and reassessed by an expert (G.J) (Fig. 4). The cephalometric tracings were performed in PNC on Dolphin 11.95 software to compatible the groups with linear and angular measurements.

Evaluation of Profile

The patients were randomized in T1 and T2 and then the evaluation of the attractiveness of the profiles was carried out through a customized questionnaire on Google Forms, generating a link, which was sent via WhatsApp Messenger and emails from orthodontists, oral and maxillofacial surgeons, laypeople.[33,34] Informed consent term was signed by all patients.

A brief questionnaire for the evaluator was made, the date of birth, sex, area of activity will be recorded (Laypeople; Laypeople / Orthodontics; Dentistry / Oral and Maxillofacial Surgery ; Dentistry). For proper calibration, the evaluator will be instructed to examine all profile images before starting to analyze them, so it will be easier to assign a fair score to each one.[27,35]

Therefore, each evaluator will judge the attractiveness through a different display order, without knowing the treatment protocol used in each case.[26,27,35]

The subjective analysis of attractiveness will be performed using a 10-point note scale (Figure 5). Grade 0 will indicate a profile considered less attractive as possible and grade 10, most attractive as possible. The evaluator may change the notes at any time before submitting the research.[26,27,35,36]

INITIAL PAR, FINAL PAR INDEX AND %PAR

The initial and final PAR index was used to assess the initial and final difficulty level of orthodontic treatment in both protocols, as described by Richmond.[37] The PAR index considers five occlusal characteristics, which were measured by one operator (G.J) in the Ortho Analyzer software (3 Shape, Copenhagen, Denmark), that is calibrated by an expert in 3D softwares and virtual Planing PGOP.[38-40]. The occlusal characteristics are posterior occlusion, overjet, overbite, crowding and midline. Each of these characteristics has well-defined criteria for measurement and will be applied to the initial and final models (Figs. 6 and 7). The PAR percentage was used to evaluate the reduction of the PAR Index by applying the following formula:

$$\%PAR = \frac{PART2 - PART1}{PART1} \times 100.$$

ABO OGS (Objective Grading System)

The calculation of the OGS index will be done by summing the scores assigned to eight criteria evaluated in plaster models or by 3D printing, which were measured by one operator (G.J), and namely: alignment, marginal ridges, buccolingual inclination,

occlusal relationships, occlusal contacts, overjet, interproximal contacts and root angulation. [41]

Error study

To evaluate the error of the method, the measurements were repeated in 30% of the sample after a month interval. The Dahlberg formula was used to evaluate the random errors and the systematic errors were evaluated with dependent t tests.

To evaluate the precision of the evaluators of the silhouettes of the questionnaire, two silhouettes were randomly repeated throughout the questions, and the Intraclass correlation coefficient (ICC) was used.

Statistical analysis

Normality and homogeneity of the variances of data were checked with Shapiro-wilk and Levene's test, respectively.

Intergroup comparability of initial age, treatment time, initial PAR index and cephalometric measurements were performed with independent t tests and sex distribution and type of malocclusion were performed with chi-square tests.

Intragroup comparison of the initial and final stages of each group was performed with dependent t tests. Intergroup comparison of the profile attractiveness was performed with independent t tests.

The comparability of the age and sex distribution of the three groups of evaluators was performed with one-way ANOVA and Tukey test and chi-square test, respectively. The score of the initial and final profile attractiveness between the three groups of evaluators was compared with one-way ANOVA and Tukey test.

Intergroup comparability of quality of finalization (OGS) and the percentage of the amount of occlusion improvement were performed with independent t tests.

The backward multiple linear regression model was used with the final atractiveness of the profile as dependent variable and OGS and %PAR as independent variables to evaluate if the independent variable were predictors of depedent variables.

Statistical analysis was performed with Statistica software (Statistica for Windows, version 12.0, Statsoft, Tulsa, Okla) and the results were considered significant for $p<0.05$.

RESULTS

The random errors varied from 0.27mm (Overbite) to 0.67mm (Overjet), and from 0.33° (SNA) to 0.93° (SNPLO). The random error of the initial PAR index, Final PAR, OGS and %PAR varied from 0.27 to 0.91. These random errors were considered acceptable. The systematic errors were not statistically significant.

The Intraclass Correlation Coefficient (ICC) of laypeople, orthodontists and maxillofacial surgeons were 0.66, 0.78 and 0.81, respectively, and this is considered satisfactory and excellent.[42]

There was comparability of the initial age, initial PAR index, sex distribution, type of malocclusion and cephalometric variables (Table 1).

In both groups, SFA and CTOS, there was an improvement of profile attractiveness with treatment (Table 2).

Before treatment, the profile was similar between the modalities SFA and CTOS group (Table 3). At the final stage, the SFA group presented a more attractive profile

than the CTOS group (Table 3). The SFA group presented a greater improvement of profile attractiveness with treatment than the CTOS group (Table 3).

The orthodontist's group was significantly older and presented more females than the other two groups (Table 4).

There was a statistically significant difference in initial profile attractiveness scores between the three groups of evaluators. The maxillofacial surgery was more critical, followed by laypeople, and the orthodontists were less critical (Table 5). For the final profile attractiveness, the orthodontists were less critical than the laypeople and the maxillofacial surgeons (Table 5).

The SFA presented a significantly shorter treatment time than CTOS (Table 6). The quality of finalization measured by the OGS index (Table VII) and the percentage of the amount of occlusion improvement measured by the %PAR (Table VIII) were significantly better in quality of finishing.

The backward multiple linear regression showed that the OGS and %PAR had a negative and positive correlation, respectively, on the final attractiveness of the profile. A great amount of occlusion improvement would generate a better silhouette attractiveness and the quality of finalization is not a predictor to a better silhouette profile at the end of the treatment. (Table IX).

DISCUSSION

The attractiveness of the profile has been the motivation for many researchers to provide scientific support to clinicians, using different methodologies to comparison.[43-48] Furthermore, the self-perception of patients with dentofacial deformities has a negative influence on the degree of happiness, self-confidence and beauty, including an attractive profile, may be related to greater professional and personal success.[1,48]

On the other hand, the return of SFA and MPOP as another treatment option, even though it is still a topic that generates a certain controversy among ortho-surgical teams.[49] Although for us seemed obvious, that most cases could be treated starting with surgery or performing a quick orthodontics, eliminating small compensations and controlling the spee curve and then eliminate the compensations with skeletal anchorage, with the same esthetic in the profile, corroborating the results of this study.[8,50]

This question depends on a series of factors such as interaction between the team of surgeons and orthodontists, the technical skill of the surgeon in performing different osteotomies, the clinical skill of the orthodontist and knowledge of orthodontic biomechanics and handling of 3D software for surgery and orthodontics and communication between this software.[51-54] Some authors report that SFA guidelines are indicated in cases where they do not have great dental compensation, with an interincisal angle close to normal, flat or slightly deepened curve, the transversal relationship of the Class I arches, and there can be no major discrepancies and the expertise of ortho-surgical team like discussed above. The guidelines to SFA they are worthy of discussion because they depend on the above factors and on the patient’s opinion.[24,25]

The results with better profile attractiveness in cases treated with SFA may seem like a bias. But for us this is a very clear issue because our approach is orthodontic-surgical driven, where surgical movements are greater and dental compensations are removed after orthodontic treatment. The fact that CTOS is linked to the completion of a Class I occlusal relationship can limit the surgeon and,

consequently, the esthetic results in the profile. Sugawara et al. 2018 perform an orthodontic-driven approach with most cases treated with one-jaw approach, which could influence facial attractiveness,[8,18], and Hernández-Alfaro et al. 2014 perform a SFA approach with surgery-driven approach, therefore they perform SFA in limited cases because their team operate based on Class I occlusion.[7] All the cases were treated by SFA with orthodontic decompensation described by Faber et al. [55] and Pereira et al. 2019 [56]which in our view increases the esthetic possibilities and the possibility of treating more patients with this approach.

Another expected result is the question of surgeons being more demanding on grades, followed by laypeople and orthodontists. Surgeons are used to observing the face more than orthodontists, who, on the contrary, observe the occlusal relationship more than the surgeon. Lay people have a self-perception in facial esthetics,[48] and historically the orthodontists have more tendency to perform compensatory treatment and are less critical than laypeople.[2,57]

The silhouettes were drawn using the submental-cervical angle it´s an important factor to an attractive profile like mentioned by Naini et al. 2016, therefore we decide to draw a part of the neck on tracings and silhouettes because an angle of the 90º to 105º is the most acetable by clinicians and laypeople. We decide to use silhouettes to avoid confounding bias due to individual preferences like skin color, hair style, and age.[26] On the other hand, Hockley et al. 2012 showed differences between photographs and silhouettes, [58] therefore Pithon et al. demonstrated that there aren't differences between both protocols,[59] and because Brazil is a country with great racial miscegenation, we prefer to use the silhouettes.

We use the PNC instead of the Frankfurt Plane (FP) because PNC is reproducible and stable and less suitable to alterations in the profile due to variations of cranial positions than FP.[28,29,60] The FP could become favorable or unfavorable the attractiveness of the profile due to alterations of the anatomic structure of Porium to Orbitale (FP) points, mainly in Class II, with a difference in the NHP.FPº of 2.04º ± 4.79 and -1.20º ± 3.03.[60]

Although the results were in favor of SFA for laypersons, maxillofacial surgeons and orthodontists, we believe that there is no clinical difference between the modalities, as long as there is a correct indication. The limitations of the SFA are patients with dental biprotrusion with maxillary and mandibular deficiency, Class II division 2, some cases of deepened bite and cases that need SARPE (Surgically Assisted Rapid Palatal Expansion) because the segmentation of the maxilla and or the mandible is not indicated. Although the shorter treatment time can be observed in the most of studies[7,21,61-68]. Only the study published by Ko et al. 2011 demonstrated that CTOS had a shorter treatment time than SFA. This study corroborated most of the studies, and one of the factors could be related to RAP (Reginal Acceleratory Phenomenon) with increasing of alkaline phosphatase and C-terminal telopeptide of type I collagen[69], SAP (Systemic Acceleratory Phenomenon)[70], and biomechanics with miniplates reducing the necessity of cooperation of the patient and extractions of premolars.[8,71] In SFA group one patient extract one upper first premolar and another patient two upper premolars. In CTOS group were extracted four first premolars in 2 patients, other two patients were extracted two upper premolars, and one case has performed a closing of the lower first molar. [72-74]

Wei et al. related in systematic review and metanalysis that SFA have a postoperative tendency to counterclockwise rotation and poor stability. In this research the results are not corroborated with this metanalysis. Another question is that the studies included in this metanalysis are so much heterogeneous, the penultimate

radiographs were performed immediately after surgery and must be immediately after debonding and we can't know if were used adequate biomechanics strategies to control this "relapse".[75] Furthermore, the authors inserted SFA and MPOP in the same group, and this generates a big bias. If there was initial alignment and leveling, "the surgery is not more first". Other systematic reviews and metanalyses showed different results from the results found by Wei and collaborators.[21,63,76] However, these studies also present very heterogeneous studies. More robust studies, such as randomized clinical trials are necessary but difficult to carry out.

Many articles have demonstrated the superiority of virtual planning when compared the traditional face-bow planning,[54] and some patients of CTOS group were treated by traditional approach and all the patients treated with SFA approach were treated by virtual ortho-surgical planning.[7,51,77-82]

A recent study using another methodology found results that corroborate with our conclusions. Beccuti et al. 2021 found in a qualitative study that SFA and CTOS had the same quantity of satisfaction but with less treatment time and immediate profile improvement. The limitations of this study are the retrospective sample and the treatment performed by different teams. Many studies with more homogenous samples, randomized clinical trials or quasi-randomized clinical trials need to be performed.

We observed that the quality of the finalization (OGS) and the amount of quantity of improvement (%PAR) were significantly better in the SFA group and that the %PAR was a predictor factor of the final attractiveness of the profile. The %PAR was better in SFA group and the efficiency of the orthodontic treatment using miniplates could affect the result, showing the importance of the orthodontists in the orthognathic surgery with both modalities.

Clinical implications

With increasing the search for beauty, a pleasant profile, and functional occlusion, many patients have advocated for SFA approach. With the findings of this study, the teams of orthodontists and maxillofacial surgeons will be able to perform SFA, MPOP and CTOS, according to indication, opinion of the patient and until the moment that the patients could perform the Surgery.

Despite the results, although the SFA had a better attractiveness of the profile, we believe that clinically the same results when the ortho-surgical team have expertise with both approaches, therefore SFA have a shorter treatment time with the immediate improvement of the profile.

Besides that, it's necessary an intensive learning curve, with literature reading and training with expert teams in this approach. We have observed that many critical performed by some colleagues happen due to a lack of deeper knowledge of the technique, performing the same in cases that are not indicated, or the necessary compensations have not been removed, co-mingling the current concept with surgery before orthodontics performed in the '60s until 2009. The technique has changed, technology has come to help surgeons and orthodontists, skeletal anchorage features, minimally invasive techniques, new osteotomy techniques and materials to complement the limitations of orthognathic surgery. It is necessary to break limiting beliefs and get out of the comfort zone.

CONCLUSIONS

In this study the SFA demonstrated better results in attractiveness of profile with better quality of finishing than COS group. SFA has become a good alternative for patients, maxillofacial surgeons, and orthodontists with shorter treatment time.

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LEGEND TO THE FIGURES

Fig. 1: Natural Head Position with same position between teleradiograph and photography.
Fig. 2: Protocol to construction the silhouettes in NHP.
Fig. 3: Silhouettes construction in T1 and T2 (T1: Pretreatment; T2: Posttreatment)
Fig. 4: Photographs in T1 and T2 to compare the NHP between photographs and silhouettes. (T1: Pretreatment; T2: Posttreatment; NHP: Natural Head Position)
Fig. 5: Silhouette with a 10-point grading on Google forms.
Fig. 6: Initial PAR index measured in the Ortho Analyzer software.
Fig. 7: Final PAR index measured in the Ortho Analyzer software.

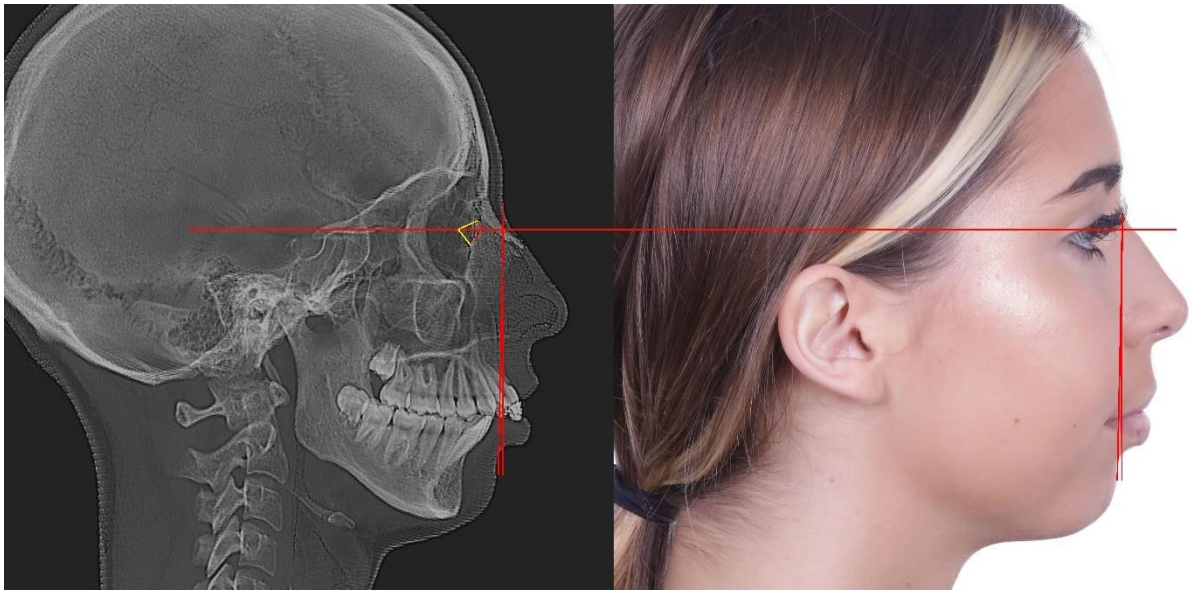

Fig. 1

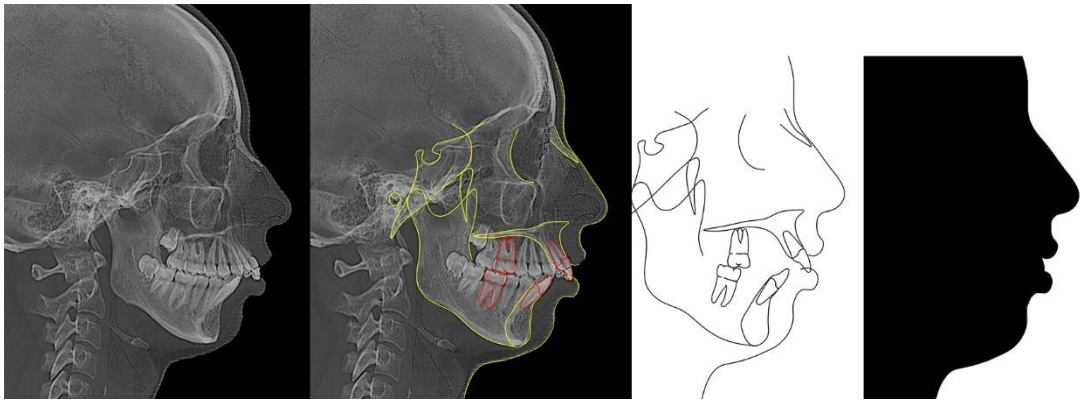

Fig. 2

Fig. 3

Fig. 4

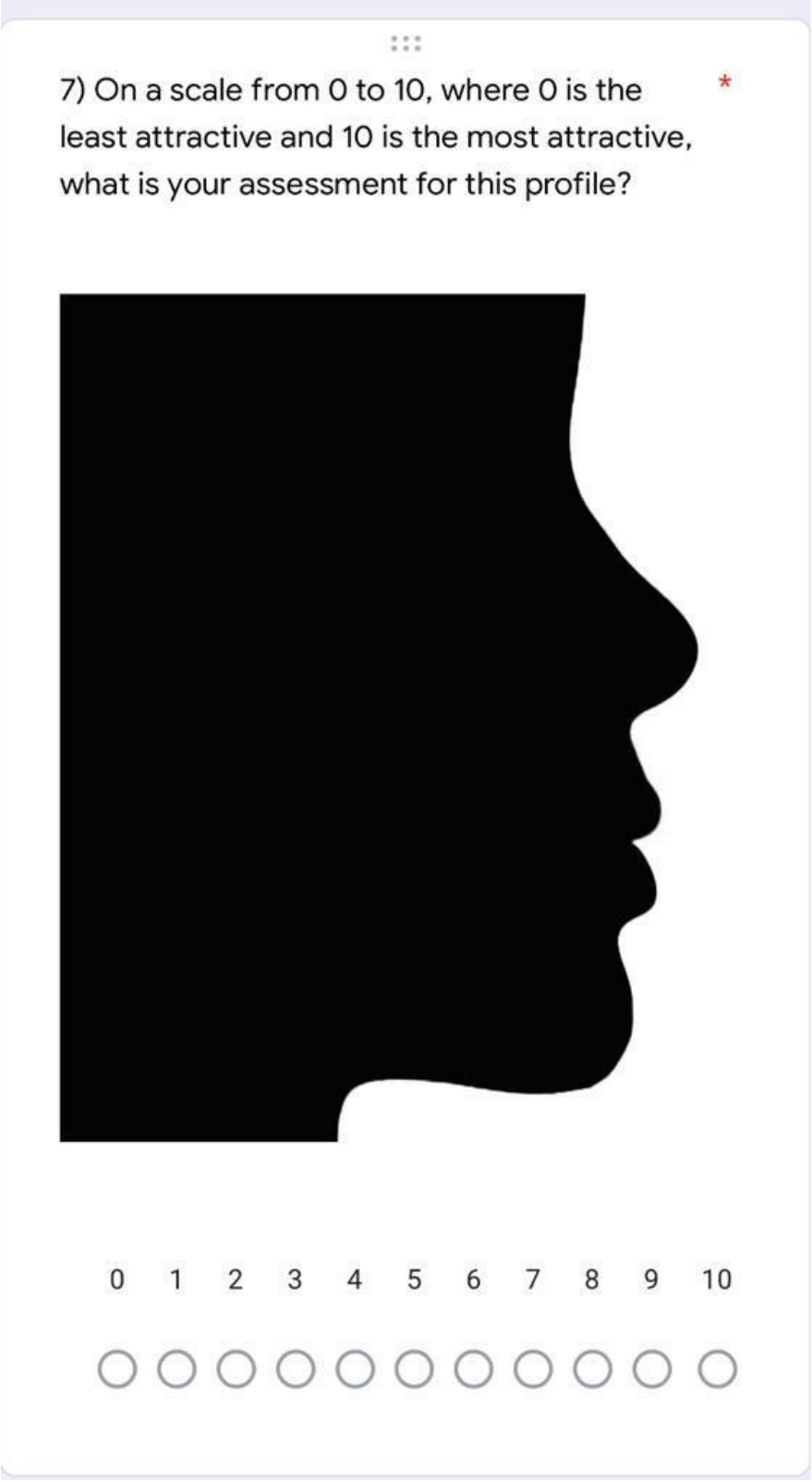
7) On a scale from 0 to 10, where 0 is the least attractive and 10 is the most attractive, what is your assessment for this profile? *
0 1 2 3 4 5 6 7 8 9 10

Fig. 5

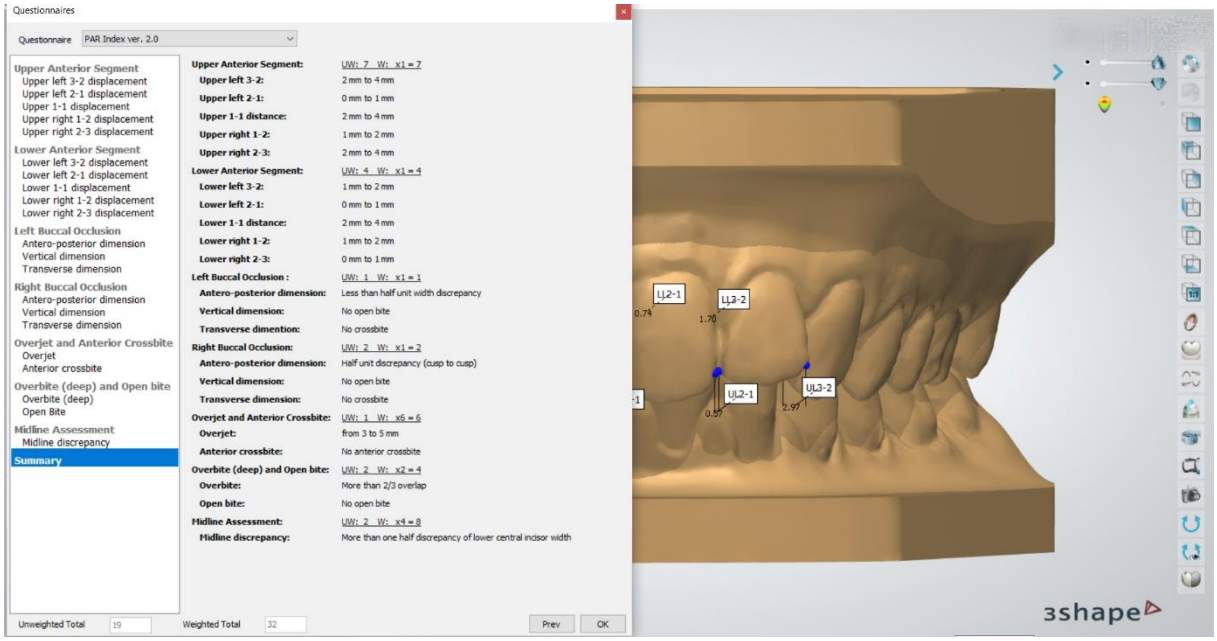
Questionnaires
Questionnaire
PAR Index ver. 2.0
Upper Anterior Segment
Upper left 3-2 displacement
Upper left 2-1 displacement
Upper 1-1 displacement
Upper right 1-2 displacement
Upper right 2-3 displacement
Lower Anterior Segment
Lower left 3-2 displacement
Lower left 2-1 displacement
Lower 1-1 displacement
Lower right 1-2 displacement
Lower right 2-3 displacement
Left Buccal Occlusion
Antero-posterior dimension
Vertical dimension
Transverse dimension
Right Buccal Occlusion
Antero-posterior dimension
Vertical dimension
Transverse dimension
Overjet and Anterior Crossbite
Overjet
Anterior crossbite
Overbite (deep) and Open bite
Overbite (deep)
Open Bite
Midline Assessment
Midline discrepancy
Summary
Upper Anterior Segment: UW: 7 W: x1 = 7
Upper left 3-2: 2 mm to 4 mm
Upper left 2-1: 0 mm to 1 mm
Upper 1-1 distance: 2 mm to 4 mm
Upper right 1-2: 1 mm to 2 mm
Upper right 2-3: 2 mm to 4 mm
Lower Anterior Segment: UW: 4 W: x1 = 4
Lower left 3-2: 1 mm to 2 mm
Lower left 2-1: 0 mm to 1 mm
Lower 1-1 distance: 2 mm to 4 mm
Lower right 1-2: 1 mm to 2 mm
Lower right 2-3: 0 mm to 1 mm
Left Buccal Occlusion : UW: 1 W: x1 = 1
Antero-posterior dimension: Less than half unit width discrepancy
Vertical dimension: No open bite
Transverse dimention: No crossbite
Right Buccal Occlusion: UW: 2 W: x1 = 2
Antero-posterior dimension: Half unit discrepancy (cusp to cusp)
Vertical dimension: No open bite
Transverse dimension: No crossbite
Overjet and Anterior Crossbite: UW: 1 W: x6 = 6
Overjet: from 3 to 5 mm
Anterior crossbite: No anterior crossbite
Overbite (deep) and Open bite: UW: 2 W: x2 = 4
Overbite: More than 2/3 overlap
Open bite: No open bite
Midline Assessment: UW: 2 W: x4 = 8
Midline discrepancy: More than one half discrepancy of lower central incisor width
Unweighted Total 19
Weighted Total 32
Prev
OK
LL2-1
LL3-2
UL2-1
UL3-2
0.74
1.70
2.99
3shape

Fig. 6

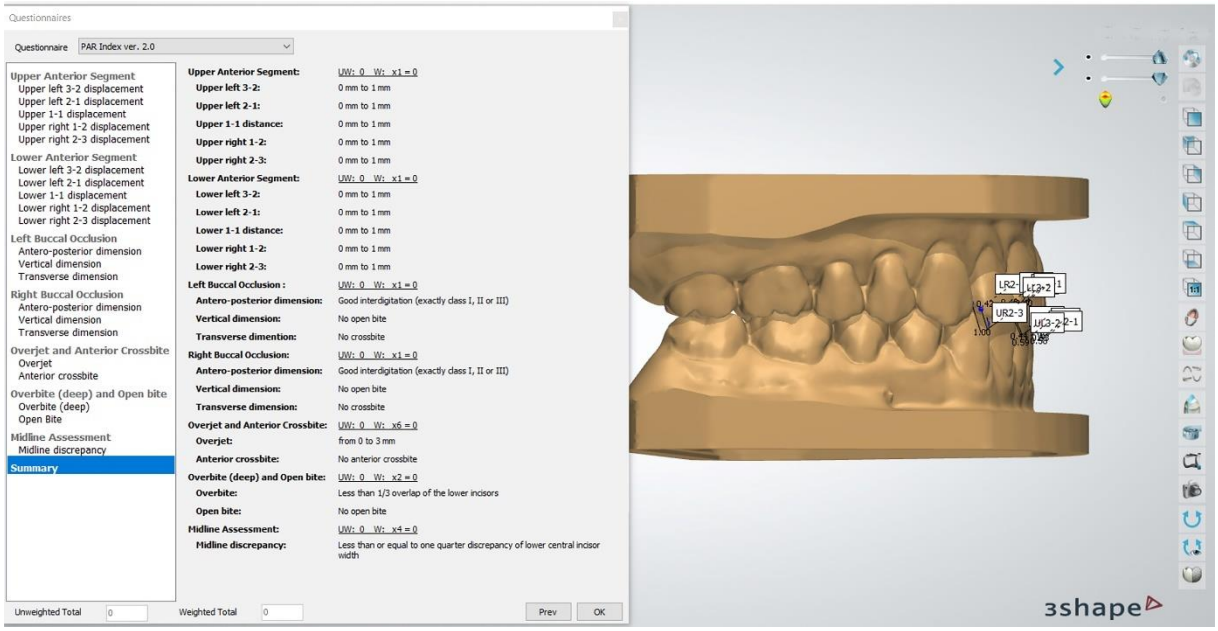
Questionnaires
Questionnaire
PAR Index ver. 2.0
Upper Anterior Segment
Upper left 3-2 displacement
Upper left 2-1 displacement
Upper 1-1 displacement
Upper right 1-2 displacement
Upper right 2-3 displacement
Lower Anterior Segment
Lower left 3-2 displacement
Lower left 2-1 displacement
Lower 1-1 displacement
Lower right 1-2 displacement
Lower right 2-3 displacement
Left Buccal Occlusion
Antero-posterior dimension
Vertical dimension
Transverse dimension
Right Buccal Occlusion
Antero-posterior dimension
Vertical dimension
Transverse dimension
Overjet and Anterior Crossbite
Overjet
Anterior crossbite
Overbite (deep) and Open bite
Overbite (deep)
Open Bite
Midline Assessment
Midline discrepancy
Summary
Upper Anterior Segment: UW: 0 W: x1 = 0
Upper left 3-2: 0 mm to 1 mm
Upper left 2-1: 0 mm to 1 mm
Upper 1-1 distance: 0 mm to 1 mm
Upper right 1-2: 0 mm to 1 mm
Upper right 2-3: 0 mm to 1 mm
Lower Anterior Segment: UW: 0 W: x1 = 0
Lower left 3-2: 0 mm to 1 mm
Lower left 2-1: 0 mm to 1 mm
Lower 1-1 distance: 0 mm to 1 mm
Lower right 1-2: 0 mm to 1 mm
Lower right 2-3: 0 mm to 1 mm
Left Buccal Occlusion : UW: 0 W: x1 = 0
Antero-posterior dimension: Good interdigitation (exactly class I, II or III)
Vertical dimension: No open bite
Transverse dimention: No crossbite
Right Buccal Occlusion: UW: 0 W: x1 = 0
Antero-posterior dimension: Good interdigitation (exactly class I, II or III)
Vertical dimension: No open bite
Transverse dimension: No crossbite
Overjet and Anterior Crossbite: UW: 0 W: x6 = 0
Overjet: from 0 to 3 mm
Anterior crossbite: No anterior crossbite
Overbite (deep) and Open bite: UW: 0 W: x2 = 0
Overbite: Less than 1/3 overlap of the lower incisors
Open bite: No open bite
Midline Assessment: UW: 0 W: x4 = 0
Midline discrepancy: Less than or equal to one quarter discrepancy of lower central incisor width
Unweighted Total 0
Weighted Total 0
Prev
OK
3shape

Fig. 7

Table 1. Results of intergroup comparability of initial ages, treatment time, initial PAR index, sex distribution, type of malocclusion and cephalometric measurements.

Variables	GROUP 1 SFA n=25	GROUP 2 CTOS n=21	P
	Mean (SD)	Mean (SD)	
Initial age (years)	31.05 (7.99)	28.81 (9.24)	0.885 ^{T}
Initial PAR index	24.40 (13.00)	22.71 (11.98)	0.652 ^{T}
Sex **Males** **Females**	 7 18	 10 11	X^2=1.88 DF=1 p=0.143 $^{\alpha}$
Type of malocclusion **Class I** **Class II** **Class III**	 4 12 9	 3 11 7	X^2=0.09 DF=2 p=0.952 $^{\alpha}$
Cephalometric measurements			
SNA (°)	83.85 (4.41)	82.26 (5.03)	0.260^{T}
SNB (°)	80.65 (6.54)	79.30 (4.89)	0.439^{T}
ANB (°)	3.19 (4.31)	2.93 (4.91)	0.851^{T}
Wits Appraisal (mm)	-0.94 (6.04)	-2.49 (7.01)	0.425^{T}
Overject (mm)	2.59 (2.98)	4.74 (5.48)	0.098^{T}
Overbite (mm)	1.22 (2.44)	0.13 (3.74)	0.242^{T}
Y Axis (SN-SGn) (°)	67.69 (6.13)	70.42 (4.43)	0.097^{T}
SNPLO (°)	7.37 (6.51)	10.32 (5.78)	0.115^{T}
U1.NA (°)	22.53 (9.43)	25.39 (7.15)	0.261^{T}
U1.PP (°)	113.64 (10.10)	112.37 (6.77)	0.626^{T}
L1.NB (°)	31.81 (8.88)	27.37 (8.97)	0.100^{T}
FMIA (°)	57.46 (12.50	58.85 (11,24)	0.695^{T}

* T independent t test; $^{\alpha}$ chi-square test

* Statistically significant for p<0.05

Table 2. Results of intragroup comparison of the initial and final profile attractiveness (independent t test).

Profile attractiveness	**Initial (T1)**		**Final (T2)**		**p**
	Mean	**SD**	**Mean**	**SD**	
SFA	2.47	1.47	6.51	1.69	**0.000**
CTOS	2.62	1.53	4.42	1.49	**0.000***

* Statistically significant for p<0.05

Table 3. Results of intergroup comparison of the profile attractiveness (independent t test).

Profile attractiveness	**GROUP 1 SFA**		**GROUP 2 CTOS**		**p**
	Mean	**SD**	**Mean**	**SD**	
Initial (T1)	2.47	1.47	2.62	1.53	**0.378**
Final (T2)	6.51	1.69	4.42	1.49	**0.000***
Treatment changes (T2-T1)	4.03	1.81	1.80	0.84	**0.000***

* Statistically significant for $p<0.05$

Table 4. Results of comparability of the groups of evaluators.

Variables	Laypeople N=60	Maxillofacial surgeons N=30	Orthodontists N=70	P
	Mean (SD)	**Mean (SD)**	**Mean (SD)**	
Age (years)	36.78 (11.78) ^{A}	38.40 (8.71) ^{B}	41.24 (10.05) ^{A}	**0.44*** ^{O}
Sex				X^2 =2.84
Female	29	16	44	DF=2
Male	31	14	26	p=**0.242** $^{\alpha}$

* Statistically significant for p<0.05

^{O} One-way ANOVA and Tukey test

$^{\alpha}$ chi-square test

Different letters in a row indicate the presence of a statistically significant difference between the groups.

Table 5. Comparison of the three groups of evaluators (one-way ANOVA and Tukey test).

Profile attractiveness	Laypeople N=60 Mean (SD)	Maxillofacial surgeons N=31 Mean (SD)	Orthodontists N=70 Mean (SD)	P
Initial (T1)	2.26 (2.15) ^{A}	1.76 (2.02) ^{B}	3.06 (2.13) ^{C}	**0.000***
Final (T2)	5.03 (2.88) ^{A}	5.05 (3.32) ^{A}	5.96 (2.39) ^{B}	**0.000***

* Statistically significant for $p<0.05$

Different letters in a row indicate the presence of a statistically significant difference between the groups.

Table 6. Results of intergroup of treatment time

Surgical Modality		N	Mean	SD	P
Treatment time (months)	**SFA**	25	12.96	6.26	**0.000***[T]
	CTOS	21	35.19	13.51	

* T independent t test;
* Statistically significant for p<0.05

Table 7. Results of intergroup comparison with ABO OGS index (independent t test).

Surgical Modality	**Mean**	**SD**	**P**
SFA	12.41[A]	3.54	**0.000***
OSA	21.57[B]	6.20	

* Statistically significant for p<0.05

Different letters in a row indicate the presence of a statistically significant difference between the groups.

Table 8. Results of intergroup comparison with %PAR (independent t test).

Surgical Modality	**Mean**	**SD**	**P**
SFA	96.54^{A}	6.82	**0.000***
CTOS	61.64^{B}	25.66	

* Statistically significant for $p<0.05$

Different letters in a row indicate the presence of a statistically significant difference between the groups.

Table 9. Backward multilinear regression analysis considering final silhouette attractiveness as dependente variable.

	Standardized	**coefficients**		**95%CI**	
Model	**Beta**	**t**	**Sig.**	**Lower limit**	**Upper limit**
Constant		4.44	.000	-3.00	1.75
OGS	-.262	-2.07	.044*	-2.79	1,33
%PAR	.506	4.00	.000*	-2.62	1.52

Note, R = 0.622, R^2=438, R^2adjusted=0.412, p <0.001.

2.2 Article 2

Smile attractiveness after conventional orthognathic three-phase surgery treatment and with surgery-first approach.

ABSTRACT

Objective: This study aimed to compare the attractiveness of the smile in patients treated with Conventional Three-phase Orthognathic Surgery (CTOS) and Surgery-First Approach (SFA). Material and methods: The sample to evaluate the attractiveness of smile comprised 40 patients that were divided into 2 groups: Group 1: 25 patients treated with SFA with mean age of 31.05 years (SD 7.99); Group 2: 15 patients treated with CTOS with mean age of 25.88 years (SD 7.67). Medical records and digital dental models or dental casts of patients treated orthodontically-surgically by SFA and by CTOS were selected retrospectively from private clinics of Belem and Bauru, Brazil. Pretreatment and posttreatment of smile were cropped in a dimension of 21 x 12.4 cm and converted to black and white after removing the hair face and blemishes to reduce the number of confusing variables. The participants of each modality were randomized in Excel in T1 and T2. Then a questionnaire with Informed Consent Form, the records of the evaluators, the randomized smile in T1 and T2 using a scale in the form of a 10-point grading was sent to WhatsApp Messenger to laypeople, orthodontists, and maxillofacial surgery. Intergroup comparability of initial age, treatment time, initial PAR index, and cephalometric measurements was performed with independent t tests and sex distribution and type of malocclusion was performed with chi-square test. The score of the initial and final smile attractiveness between the three groups of evaluators was compared with one-way ANOVA and Tukey test. To evaluate the association of the surgical modalities with the OGS, %PAR and the final attractiveness of the smile, the Spearman Correlation test was used. Results: In both groups, SFA and CTOS, there was an improvement of smile attractiveness with treatment. Before treatment, the smile of the CTOS group was significantly less attractive than the SFA group. At the final stage, the SFA group presented a more attractive and greater improvement of the smile than the CTOS group. Laypeople and maxillofacial surgeons were more critical than orthodontists at the initial smile attractiveness. Laypeople were more critical than orthodontists and maxillofacial surgeons at the final smile attractiveness. Conclusions: In this study the SFA demonstrated better results in attractiveness of smile with better quality of finishing than COS group. SFA has become a good alternative for patients, maxillofacial surgeons and orthodontists with shorter treatment time.

Keywords: Malocclusion. Orthognathic surgery. Esthetic.

INTRODUCTION

Facial attractiveness is very important in people's social relationships. It is relevant to personal, affective, and professional success. Facial attractiveness influence personality traits like self-esteem, leadership, and emotional balance.[1-3] The attractiveness of the face has a strong relationship with a harmonious and attractive smile.[1]

The esthetic perception of everyone varies according to different criteria: social environment, gender, age, and personal experiences.[4] For the same reason the traits of beauty on facial profiles between laypeople and dentists appear to be different.[5] Although there may be differences in the preference for an attractive smile between orthodontists and their patients, there is a common sense that both seek to achieve beautiful smiles, both the patient and the professional. On the other hand, the impact of malocclusion has a negative relationship in the smile attractiveness.[3]

Individuals who have facial beauty traits and an attractive smile are often seen by individuals with facial deformities as mirrors.[6] Facial deformities generally show discrepancies in the bone bases in the anteroposterior, vertical direction, or a combination of the two[4,7] and these individuals frequently presented low selfie-stream, anxiety and more difficulty to social, affective and professional relationships.[1,8]

In patients with severe dentofacial deformities the orthodontic camouflage[GO1] treatment is not able to restore the correct relationship between the upper and lower incisors and restore acceptable or pleasant facial esthetics to the patient.[8] In this regard, orthognathic surgery appears as the best solution for returning function, facial and smile esthetics.[8] Individuals with borderline dentofacial deformities may experience an improvement in the face and smile, but to a lesser extent than individuals who opt for surgical orthodontic treatment.[6]

An attractive smile is influenced by several factors such as smile display, buccal corridor, symmetry, smile arch, teeth color, proportion, among others.[6] What is often not possible to achieve with just orthodontic treatment alone, is to associate orthognathic surgery and other areas of dentistry and medicine.[9-12]

Orthognathic surgery in patients with dentofacial deformities can be performed by basically two different modalities, the Conventional Three-Phase Orthognathic Surgery (CTOS) and the Surgery-First Approach (SFA).[13-17] More recently, a new modality was relaunched, called Minimal Presurgical Orthodontic Preparation, where an initial orthodontic treatment ranging from 1 to 6 months would be performed to eliminate occlusal interference observed in SFA, reducing a possible surgical relapse.[18,19]

The CTOS assumed an important role from 1976 onwards since Worms et al. 1976 agreed with the orthodontic-first approach to all cases of orthognathic surgery. Although the SFA was performed since the 1960's decade,[20-23],[13] the big paradigm shift when Nagasaka et al. 2009 reported the need to overcorrect the bases to achieve a class I skeletal relationship and then eliminate dental compensations with orthodontic miniplates.[24,25]

Since then, many ortho-surgical teams around the world have used SFA in some patients with dentofacial deformities.[26-30] Many patients and ortho-surgical teams have advocated in favor of SFA due to an immediate improvement in the profile, shorter

treatment time with the same level of satisfaction on the part of patients and a possible superiority in quality of life when compared to conventional surgery.[13,15,30-33]

On the other hand, some authors have demonstrated a relapse with a tendency to counterclockwise rotation of the mandible. Although there is controversy regarding this issue, this relapse could interfere in the final occlusal results and, consequently, differences in the attractiveness of the smile when compared to CTOS. (Hsu et al, 2013; Choi et al., 2016; Kim et al., 2014; Kim, et al.,2014; Wei et al., 2018)(Yang et al., 2017; Sharma et al., 2015; Soverina et al., 2019; Huang et al., 2014; Hsu et al., 2013; Ko et al., 2011; Park et al., 2015; Park et al. 2016; Liao et al, 2010)

OBJECTIVES

This study aimed to retrospectively evaluate the attractiveness of the smile in the pretreatment (T1), posttreatment (T2) and treatment time in patients with dentofacial deformities treated by the CTOS and SFA.

MATERIAL AND METHODS

The study was approved by the Ethics in Research Committee of Bauru Dental School, University of São Paulo, Brazil (protocol number CAAE: 51458521.6.0000.5417, decision number: 5.054.066).

MATERIAL AND METHODS

Sample size calculations (patients)

The sample size calculation was based on an alpha significance level of 5% (0.05) and a beta of 20% (0.20) to achieve 80% power test to detect a minimum difference of 0.62 points with a standard deviation of 0.59 for the smile attractiveness score (Negreiros et al, 2020). Thus, the sample size calculation resulted in the need for at least 15 patients in each group.

Sample size calculations (evaluators)

The sample size calculation was based on an alpha significance level of 5% (0.05) and a beta of 20% (0.20) to achieve 80% power test to detect a minimum difference of 0.41 points with a standard deviation of 0.59 for the smile attractiveness score (Negreiros et al, 2020). Thus, the sample size calculation resulted in the need for at least 34 evaluators in each group.

PARTICIPANTS

Eligibility Criteria

To provide greater reliability to the results that may be obtained, the medical records will be selected according to the following criteria: Complete initial and final orthodontic documentation, two-jaw surgery, absence of craniofacial anomalies, complete initial diagnosis, plaster models or 3D prints in good condition. **Exclusion**

criteria consisted of patients with craniofacial anomalies or syndromes, one-jaw surgery, supernumerary and / or anomalous teeth. Consecutive patients, within the inclusion criteria, were retrospectively selected from the files of private orthodontic clinics of Bauru and Belem, Brazil, from March 2004 to December 2020. Seventy-six medical records were evaluated, forty-five were SFA modality and Thirty-one were CTOS.

The sample was divided into two groups: Group 1 consisted of 15 subjects treated with CTOS with a mean age of 25.88 years (SD 7.67), 5 were male and 10 females, 3 were Class I, 8 Class II and 4 Class III. And Group 2, composed of 25 patients treated with SFA, with mean age of 31.05 years (SD 7.99), 7 were male and 18 females, 4 were Class I, 12 Class II and 9 Class III. All the patients received bimaxillary surgery with Lefort I in the upper jaw and bilateral sagittal split osteotomy (BSSO) in both groups. In the SFA group, the patients did not receive any orthodontic treatment before surgery and the brackets were positioned by the same operator (P.G.O.P) a week before the surgery and the wire a day before the procedure in all cases. The ortho-surgical treatment was made by a single orthodontist (P.G.O.P) and surgeon (F.S.N.F) with thirteen years as specialist in orthodontics and maxillofacial surgery. The orthodontic treatment begins 15 to 21 days after surgery. All the patients that were treated with SFA received four miniplates in strategics sides, depending on the biomechanics necessity and no patient remained with the final guides after surgery. Surgical stabilization was maintained with intermaxillary elastics and orthodontic miniplates. Nine of these patients were treated by lingual technique, three with Invisalign e and the others thirteen with labial multibrackets technique. The CTOS group was treated by the same orthodontist (M.J) with twenty-six years as specialist in orthodontics and surgeon (E.S) with twenty-seven years as specialist in maxillofacial surgery, and all patients were treated with labial multibrackets technique. The orthodontic treatment begins 45 days after surgery. For both groups lateral cephalograms, photography and dental casts were obtained. The groups were made compatible regarding (1) initial age, (2) treatment time, (3) distribution between the sexes, (4) malocclusion type and (5) cephalometric variables (Table 1).

Cephalometric variables.

The teleradiographs were oriented with the photographs in NHP (Natural Head Position) using a horizontal line across the C point (the most prominent point of the Cornea) and a vertical line, like described by Lundström et al. 1995 and Finn et al. 2019 (Fig 1).[34,35] All the cephalometric tracing and orientation of the head were calibrated between the operator (PGOP) and an expert (GJ). All the vertical angles between the vertical line and N'-PG in cephalometric radiograph and photography were measured with open-source Image J software with a tolerance level of 0.3° degrees. Then all the cephalometric measurements were performed on Dolphin software version 11.95 in PNC.

Smile evaluation

Patients were instructed to show a pleasant smile and as natural as possible with their teeth in MIH (Maximum Habitual Intercuspidation).[36-38] (Fig.2a and 2b) Several frontal photographs using a Canon 6D photographic camera (Tokyo, Japan) were taken of each patient, and the most pleasant one will be included in the sample.[39] All photographs were obtained in manual mode, colored, with fine quality, ISO

(International Organization of Standardization) 800, diaphragm opening of at least 16 and a shutter speed of 125, with standardized flash in multi ¼. The macro lens was always adjusted to focus on the patient's lips, at a distance of 60 cm from the soft tissue, obtaining an image of the lower third of the face, which goes approximately from the tip of the nose to the middle of the chin.[38-40]

All images will be imported into Adobe Photoshop 2020 and resized to a size close to the actual size.[37] To eliminate the influence of confounding factors, such as skin tone, lips and teeth, the images will be cut out and evaluated in black and white.[37,38] (Fig.2c and 2d).

Evaluation of Smile Attractiveness

The evaluation of the attractiveness of the smile profiles was carried out through a customized form on Google Forms, generating a link, which was sent via WhatsApp Messenger and emails from orthodontists, oral and maxillofacial surgeons, lay people.[41,42] Informed consent term was signed by all patients.

A brief questionnaire for the evaluator was made, the date of birth, sex, area of activity will be recorded (Laypeople; Laypeople / Orthodontics; Dentistry / Oral and Maxillofacial Surgery; Dentistry). For proper calibration, the evaluator will be instructed to examine all smile images before starting to analyze them, so it will be easier to assign a fair score to each one.[37,38]

Therefore, each evaluator will judge the attractiveness through a different display order, without knowing the treatment protocol used in each case.[37,38,43]

The subjective analysis of attractiveness will be performed using a 10-point note scale (Figure 3). Grade 0 will indicate a smile considered as least attractive as possible and grade 10, as attractive as possible. The evaluator may change the notes at any time before submitting the research, both in the questionnaire on Google Forms.[44,45]

INITIAL PAR INDEX

The initial PAR index was used to assess the initial difficulty level of orthodontic treatment in both protocols, as described by Richmond.[46] The PAR index considers five occlusal characteristics, which were measured the operator (G.J) in the Ortho Analyzer software (3 Shape, Copenhagen, Denmark), that is calibrated by an expert in 3D software and virtual Planing PGOP.[47-49] The occlusal characteristics are posterior occlusion, overjet, overbite, crowding and midline. Each of these characteristics has well-defined criteria for measurement and will be applied to the initial models (Fig. 4).

OGS, final PAR index and %PAR evaluation

To evaluate the final quality of the result of the treated cases, which was compared between the two protocols, the OGS Index was used in all patients in the sample.[50] The same examinator (G.J) performed all measurements of this study, then the objective grading system (OGS) index and PAR index were evaluated in both groups to analyze the finishing quality in the COS and SFA.

The calculation of the OGS index was done through the sum of the scores attributed to eight criteria evaluated in the plaster models or by 3D printing, these being: alignment, marginal ridges, bucco-lingual inclination, occlusal relations, occlusal contacts, overjet, interproximal contacts, and root angulation. [50]

The final PAR index was used to assess the amount the occlusion improvement. of orthodontic treatment in both protocols, as described by Richmond.[46] modality. The

PAR index considers five occlusal characteristics, which were measured the operator (G.J) in the Ortho Analyzer software (3 Shape, Copenhagen, Denmark), that is calibrated by an expert in 3D software and virtual Planing PGOP.[47-49] The PAR percentage was used to evaluate the reduction of the PAR Index by applying the following formula:

$$\%PAR = \frac{PART2 - PART1}{PART1} \times 100.$$

Error study

To evaluate the error of the method, the measurements were repeated in 30% of the sample after a month interval. The Dahlberg formula was used to evaluate the random errors and the systematic errors were evaluated with dependent t tests.

To evaluate the precision of the evaluators of the smiles of the questionnaire, two smiles were randomly repeated throughout the questions, and the Intraclass correlation coefficient (ICC) was used.

Statistical analysis

Normality and homogeneity of the variances of data were checked with Shapiro-wilk and Levene's test. respectively.

Intergroup comparability of initial age. treatment time and initial PAR index were performed with independent t tests and sex distribution and type of malocclusion were performed with chi-square test.

Intragroup comparison of the initial and final stages of each group was performed with dependent t tests. Intergroup comparison of the profile attractiveness was performed with independent t tests.

The comparability of the age and sex distribution of the three groups of evaluators was performed with one-way ANOVA and Tukey test and chi-square test. respectively.

The correlation between the surgical modality and the variables OGS, %PAR and final attractiveness of the smile was performed with Spearman's correlation.

Statistical analysis was performed with Statistica software (Statistica for Windows. version 12.0. Statsoft. Tulsa. Okla) and the results were considered significant for $p<0.05$.

RESULTS

The random errors varied from 0.27mm (Overbite) to 0.91mm (Overjet), and from 0.33° (L1.NB) to 0.89° (U1.L1). The random error of the initial PAR index, Final PAR, OGS and %PAR varied from 0.27 to 0.91. These random errors were considered acceptable. The systematic errors were not statistically significant.

The Intraclass Correlation Coefficient (ICC) of laypeople, orthodontists and maxillofacial surgeons were 0.67, 0.75 and 0.81, respectively, and this is considered satisfactory and excellent.[51]

There was comparability of the initial age, sex distribution and type of malocclusion (Table 1).

In both groups, SFA and CTOS, there was a significant improvement in the smile attractiveness with treatment (Table 2).

Before treatment, the smile of the CTOS group was significantly less attractive than the SFA group, although this difference is very small. 2.44 and 2.59. respectively (Table 3). At the final stage. the SFA group presented a more attractive smile than the CTOS group (Table 3). The SFA group presented a greater improvement of smile attractiveness with treatment than the CTOS group (Table 3).

There were no differences between the ages of laypeople. orthodontists and maxillofacial surgeons (Table 4). The laypeople group had more females in contrast to the other two groups of evaluators.

For the initial smile attractiveness. the laypeople and maxillofacial surgeons were more critical than orthodontists (Table 5). For the final smile attractiveness. the laypeople were more critical than the other two groups (Table 5).

The SFA group presented a shorter treatment time than the CTOS group, with better improvement in the orthodontic treatment, and quality of the finalization (Table 6).

The Spearman correlation result in a Spearman's correlation showed a strong and positive correlation of the surgical modality with the quality of finalization (OGS), and a moderate and strong negative correlation, respectively, with the final attractiveness of the smile and %PAR (Table 7).[52]

DISCUSSION

The main reasons for patients with dentofacial deformities to seek ortho-surgical treatment are esthetic, functional, and self-steam.[53-55] Although there is controversy when this topic is involved, [56,57] most of the research corroborate that the esthetic is the main reason.[55,57] The patients with dentofacial deformities were less happy when compared with patients without dentofacial appearance with their dental appearance, especially women with Class II malocclusion. The shape and dental protrusion of teeth were the most frequent causes of concern.[58]

The ortho-surgical teams and patients have two modalities of orthognathic surgery: the SFA and CTOS.[13-17] Although many patients have advocated by SFA due the immediate esthetic profile and less orthodontic treatment time with similar facial esthetic and self-satisfaction, [30] it's important to investigate if the attractiveness of the smile has differences between this two approaches. Many articles have demonstrated the attractiveness between modalities of orthodontic treatment [6,9,37,38] but none compare these orthognathic-surgery approaches. Therefore, this article was performed to investigate this issue.

The sample was matched according to age, sex, type of malocclusion, degree of initial malocclusion difficulty (initial PAR index) and dental and linear and angular cephalometric variables, demonstrating a good degree of compatibility between the groups (Table I).

In this study the SFA group presented smiles more attractive than CTOS group, although both groups presented a great improvement. One of the issues can be explained by the best results in how much the occlusion improvement (final PAR index) when compared with CTOS group (Table 7). Previous articles demonstrated that the ideal score of final PAR index should be shorter than score 7 and we can observe a

great difference between the groups.[37,59] This issue can be explained because the CTOS sample is treated with a more traditional approach, depending on greater patient cooperation. All the patients treated with SFA received four miniplates, which facilitate movements in the three planes of space without depending on the patient's cooperation.[25]

Another factor that could affect the smile attractiveness in orthodontics and ortho-surgical treatment is the quantity of gingival display demonstrating that a smile with ± 4mm is less unattractive in the opinion of orthodontists, dentists, and laypeople.[4] Furthermore, esthetic can be affected by level of education, social status, [60]and culture.[4] The most attractive gingival display it varies from 0 to +2mm of gingival display, with differences in the opinion of laypeople, dentists, orthodontists, and the orthodontists were more critical corroborated with our results.[61] Three of fifteen patients treated with CTOS yet presented a gingival above to 3mm after the orthognathic surgery, which it's considered less attractive between the orthodontists, dentists, and laypeople. [4]{Valverde-Montalva, 2021 #2934

The soft tissue position has a significant level of contribution to the smile attractiveness. The curvature of the upper lip is classified as downward, straight, and upright, and the first one is considered the less unattractive.{Van der Geld, 2011 #2935}. The more downward with more gingival display, the less attractive the smile becomes.[62] A study demonstrated that the relationship between the lips before and after the orthognathic surgery became better compared with the pretreatment and the control group. The upper and lower lips on smiling moved significantly laterally and superiorly made the smile more attractive.[63]

Not least the curvature of the lower lip plays an important role in the attractiveness of the smile.[60] In this study the laypeople preferred a smile with 2mm recovered the upper incisors and 2mm of exposition of lower incisors, while the orthodontists and preferred a smile with 0.5mm recovered the upper incisors and 0.5mm of exposition of lower incisors. Only one of the patients in the SFA group presented an inferior labial line bigger than 2mm and between the CTOS group four patients presented the lower lip bigger than 2mm, showing an unattractive exposure of the lower lip and consequently the attractiveness of smile.[60]

The smile arc is another important factor in achieving an attractive smile. The relationship between the curvature of upper incisors and canines edge to the curvature of the lower lip is defined as smile arch.[64] Some factors are important to get a smile arch relationship and include the midline deviation, inclination of maxillary incisors, diastemas, the lengths of the maxillary teeth, the curvature of lower lip, arch width, and the occlusal plane angle.[10,65] Both, orthodontic and surgical treatment can affect the occlusal plane and consequently the smile arch.[66,67] An ideal occlusal plane angle must have 10° of inclination in relation to a true horizontal line, showing a small level of gingival display.[3] The ortho-surgical teams must be an attempt in this question because the rotation of occlusal angle is frequently used in orthognathic surgery,[68] and this fact could improve the face and make the smile less attractive.[3] In CTOS two patients presented an occlusal plane less than ideal, showing more gingival display the posterior region. And in the SFA only one patient presented the same condition.

The inclination of premolars and canines is another question that must be well planned by ortho-surgical teams because the orthodontists preferred an inclination of canines from 0° to -7° and -3° to -11° in the premolars inclination, and the lay people

another time have a different opinion compared by the orthodontists, having a greater tolerance range, showing that orthodontists are more critical,[69] corroborating the findings of this study.

Kaya and Uyar 2017 evaluated the gingival display associated with occlusal canting and found that increasing both, gingival display and occlusal plane decrease the attractiveness of smile and the orthodontists were more critical another time than dentists and laypeople. How we can receive many factors affect the smile attractiveness in the three planes of the space: roll, pitch, and yaw, associated with soft tissues mainly the upper and lower lip, as described by Ackerman et al. 2007.[70]

In this study, the surgical modality showed a strong correlation between the quality of the finalization and the surgical modality. The orthodontists must attempt to this fact because it probably affects the final smile attractiveness in patients with dentofacial deformities.

In summary, the literature has a lack of studies comparing the influence of teeth and lips in macro and micro esthetics combined with orthognathic surgery. Many variables influence the smile attractiveness, mainly in patients with dentofacial and the ortho-surgical teams need to be attempted to all these factors.

Clinical implications

With increasing in the search for beauty, a pleasant profile and smile, as soon as a functional occlusion, many patients have chosen for SFA approach. With the findings of this study, the teams of orthodontists and maxillofacial surgeons will be able to perform SFA, MPOP and CTOS, according to indication, opinion of the patient and until the moment that the patients could perform the Surgery.

Despite the results, although the SFA had a better attractiveness of the smile, we believe that clinically the same results, because some factor could affect the result. After all, all the cases of SFA were planned with a virtual approach, therefore SFA has a shorter treatment time with the immediate improvement of the profile.

Besides that, it is necessary an intensive learning curve, with literature reading and training with expert teams in this approach. We have observed that many critical performed by some colleagues happen due to a lack of deeper knowledge of the technique, performing the same in cases that are not indicated, or the necessary compensations have not been removed, co-mingling the current concept with surgery before orthodontics performed in the ’60s until 2009. The technique has changed, technology has come to help surgeons and orthodontists, skeletal anchorage features, minimally invasive techniques, new osteotomy techniques and materials to complement the limitations of orthognathic surgery. It is necessary to break limiting beliefs and get out of the comfort zone.

CONCLUSIONS

In this study the SFA demonstrated better results in attractiveness of profile with better quality of finishing than COS group. SFA has become a good alternative for patients, maxillofacial surgeons, and orthodontists with shorter treatment time.

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Fig 1: Methods to perform the cephalometric tracings in T1 Pretreatment) and T2 (Posttreatment) in Natural Head Position (NHP)
Fig.2: Photographs to reduce confounding variables: (A) original image , (B) i mage cropped at a standardized proportion of 21 × 12.4 cm , (C) e limination of facial blemishes and facial hair , (D) image conversion to black and white.
Fig.3: Questionnaire of smile attractiveness on Google Forms.
Fig.4: Initial PAR index.
Fig.5 Final PAR index

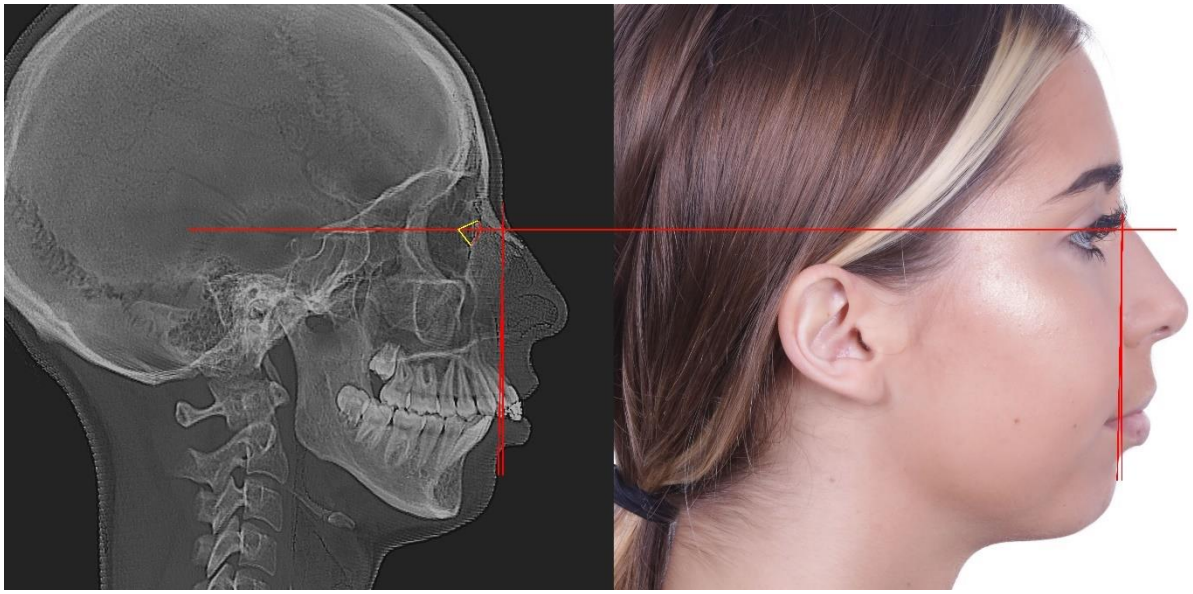

Figure 1

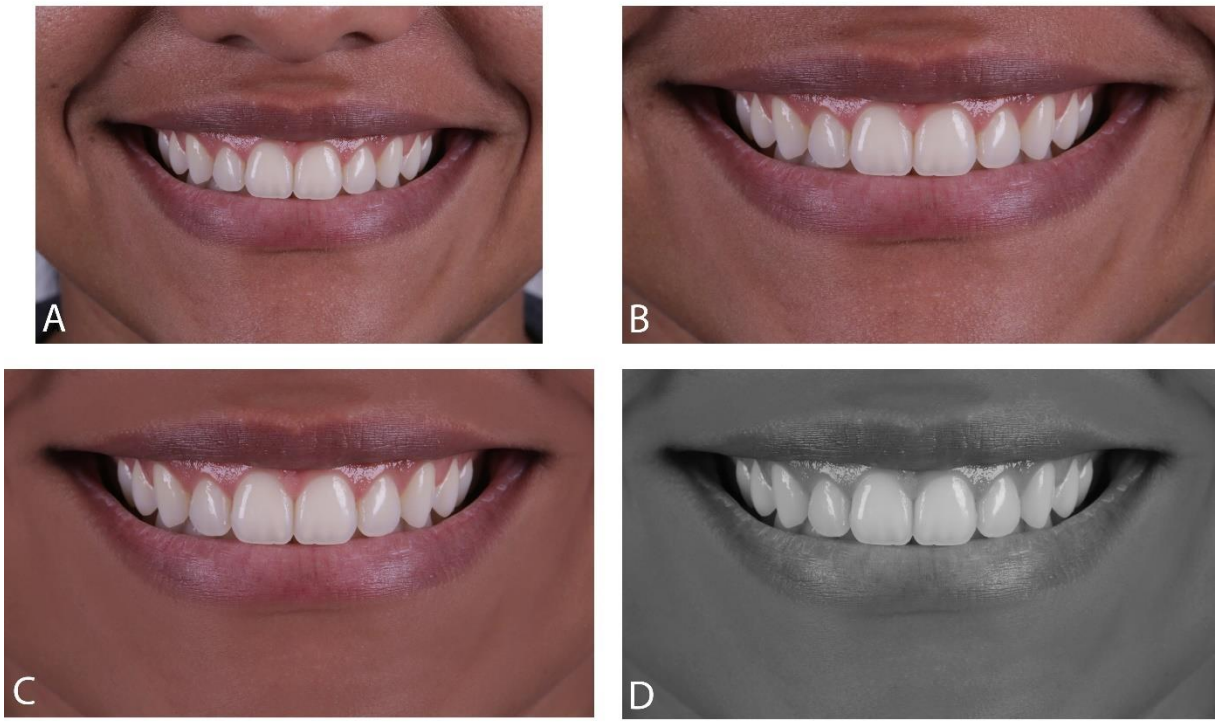

Figure 2

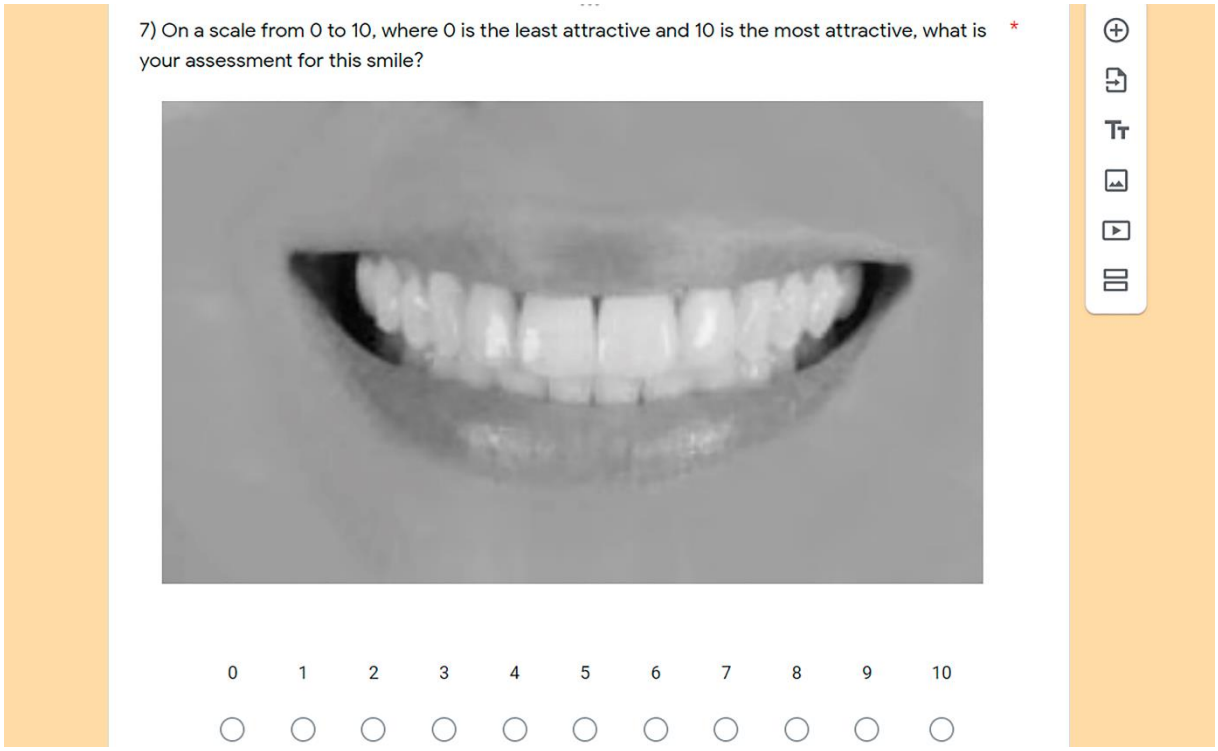
7) On a scale from 0 to 10, where 0 is the least attractive and 10 is the most attractive, what is your assessment for this smile? *
0 1 2 3 4 5 6 7 8 9 10

Figure 3

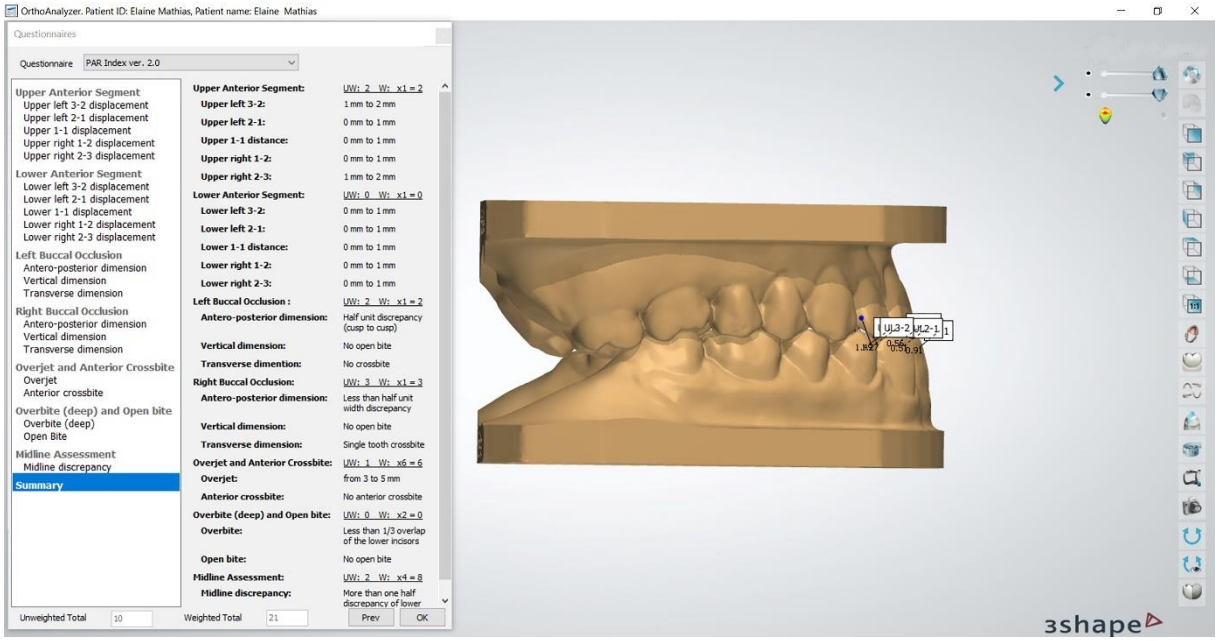
OrthoAnalyzer. Patient ID: Elaine Mathias, Patient name: Elaine Mathias
Questionnaires
Questionnaire
PAR Index ver. 2.0
Upper Anterior Segment
Upper left 3-2 displacement
Upper left 2-1 displacement
Upper 1-1 displacement
Upper right 1-2 displacement
Upper right 2-3 displacement
Lower Anterior Segment
Lower left 3-2 displacement
Lower left 2-1 displacement
Lower 1-1 displacement
Lower right 1-2 displacement
Lower right 2-3 displacement
Left Buccal Occlusion
Antero-posterior dimension
Vertical dimension
Transverse dimension
Right Buccal Occlusion
Antero-posterior dimension
Vertical dimension
Transverse dimension
Overjet and Anterior Crossbite
Overjet
Anterior crossbite
Overbite (deep) and Open bite
Overbite (deep)
Open Bite
Midline Assessment
Midline discrepancy
Summary
Upper Anterior Segment: UW: 2 W: x1 = 2
Upper left 3-2: 1 mm to 2 mm
Upper left 2-1: 0 mm to 1 mm
Upper 1-1 distance: 0 mm to 1 mm
Upper right 1-2: 0 mm to 1 mm
Upper right 2-3: 1 mm to 2 mm
Lower Anterior Segment: UW: 0 W: x1 = 0
Lower left 3-2: 0 mm to 1 mm
Lower left 2-1: 0 mm to 1 mm
Lower 1-1 distance: 0 mm to 1 mm
Lower right 1-2: 0 mm to 1 mm
Lower right 2-3: 0 mm to 1 mm
Left Buccal Occlusion : UW: 2 W: x1 = 2
Antero-posterior dimension: Half unit discrepancy (cusp to cusp)
Vertical dimension: No open bite
Transverse dimention: No crossbite
Right Buccal Occlusion: UW: 3 W: x1 = 3
Antero-posterior dimension: Less than half unit width discrepancy
Vertical dimension: No open bite
Transverse dimension: Single tooth crossbite
Overjet and Anterior Crossbite: UW: 1 W: x6 = 6
Overjet: from 3 to 5 mm
Anterior crossbite: No anterior crossbite
Overbite (deep) and Open bite: UW: 0 W: x2 = 0
Overbite: Less than 1/3 overlap of the lower incisors
Open bite: No open bite
Midline Assessment: UW: 2 W: x4 = 8
Midline discrepancy: More than one half discrepancy of lower
Unweighted Total 10
Weighted Total 21
Prev
OK
3shape

Figure 4

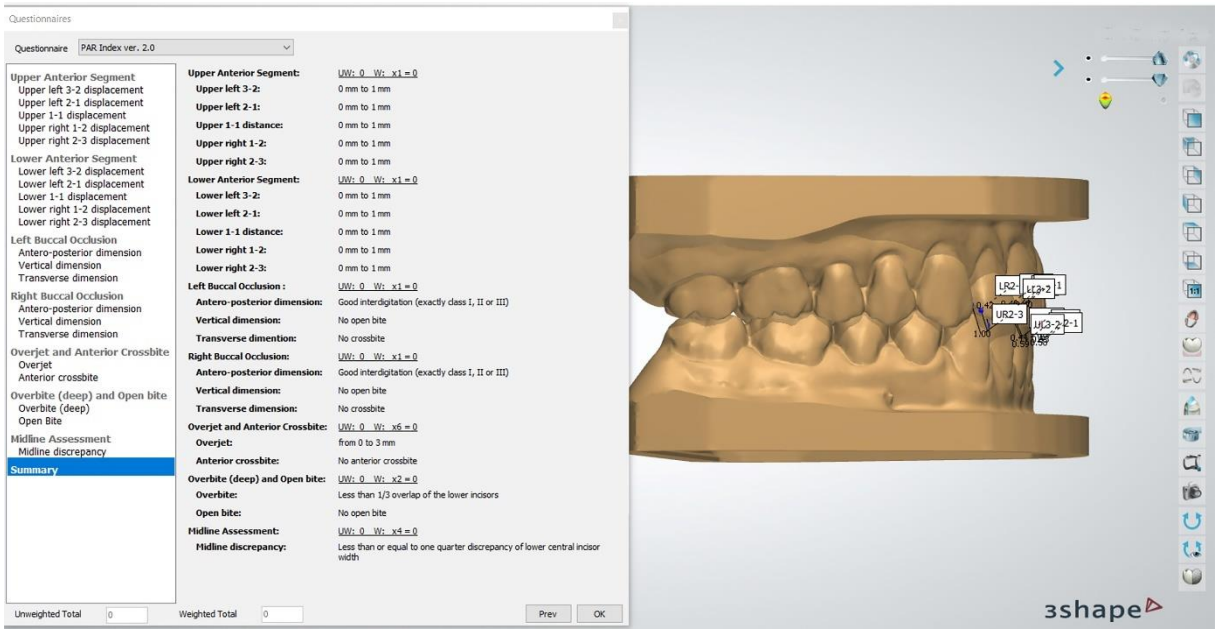
Questionnaires
Questionnaire
PAR Index ver. 2.0
Upper Anterior Segment
Upper left 3-2 displacement
Upper left 2-1 displacement
Upper 1-1 displacement
Upper right 1-2 displacement
Upper right 2-3 displacement
Lower Anterior Segment
Lower left 3-2 displacement
Lower left 2-1 displacement
Lower 1-1 displacement
Lower right 1-2 displacement
Lower right 2-3 displacement
Left Buccal Occlusion
Antero-posterior dimension
Vertical dimension
Transverse dimension
Right Buccal Occlusion
Antero-posterior dimension
Vertical dimension
Transverse dimension
Overjet and Anterior Crossbite
Overjet
Anterior crossbite
Overbite (deep) and Open bite
Overbite (deep)
Open Bite
Midline Assessment
Midline discrepancy
Summary
Upper Anterior Segment: UW: 0 W: x1 = 0
Upper left 3-2: 0 mm to 1 mm
Upper left 2-1: 0 mm to 1 mm
Upper 1-1 distance: 0 mm to 1 mm
Upper right 1-2: 0 mm to 1 mm
Upper right 2-3: 0 mm to 1 mm
Lower Anterior Segment: UW: 0 W: x1 = 0
Lower left 3-2: 0 mm to 1 mm
Lower left 2-1: 0 mm to 1 mm
Lower 1-1 distance: 0 mm to 1 mm
Lower right 1-2: 0 mm to 1 mm
Lower right 2-3: 0 mm to 1 mm
Left Buccal Occlusion : UW: 0 W: x1 = 0
Antero-posterior dimension: Good interdigitation (exactly class I, II or III)
Vertical dimension: No open bite
Transverse dimention: No crossbite
Right Buccal Occlusion: UW: 0 W: x1 = 0
Antero-posterior dimension: Good interdigitation (exactly class I, II or III)
Vertical dimension: No open bite
Transverse dimension: No crossbite
Overjet and Anterior Crossbite: UW: 0 W: x6 = 0
Overjet: from 0 to 3 mm
Anterior crossbite: No anterior crossbite
Overbite (deep) and Open bite: UW: 0 W: x2 = 0
Overbite: Less than 1/3 overlap of the lower incisors
Open bite: No open bite
Midline Assessment: UW: 0 W: x4 = 0
Midline discrepancy: Less than or equal to one quarter discrepancy of lower central incisor width
Unweighted Total 0
Weighted Total 0
Prev
OK
LR2-
UR2-3
3shape

Figure 5

Table 1**.** Results of intergroup comparability of initial ages. treatment time. initial PAR index. sex distribution and type of malocclusion.

Variables	**GROUP 1 SFA n=25**	**GROUP 2 CTOS n=15**	**P**
	Mean (SD)	**Mean (SD)**	
Initial age (years)	31.05 (7.99)	25.88 (7.67)	0.051 ^{T}
Initial PAR index	24.40 (13.00)	23.73 (12.98)	0.876 ^{T}
Sex **Males** **Females**	 7 18	 5 10	X^2=0.13 DF=1 p=0.495 $^{\alpha}$
Type of malocclusion **Class I** **Class II** **Class III**	 4 12 9	 3 8 4	X^2=0.39 DF=2 p=0.823 $^{\alpha}$
SNA (°)	83.85 (4,41)	81.84 (4.41)	0.175^{T}
SNB (°)	80.65 (6.54)	78.54 (5.04)	0.291^{T}
ANB (°)	3.19 (4.31)	3,28 (5.25)	0.953^{T}
Wits Appraisal (mm)	-0.94 (6.04)	-3.26 (7.57)	0.291^{T}
Overject (mm)	2.59 (2.98)	4.88 (5.99)	0.115^{T}
Overbite (mm)	1.22 (2.44)	-0.24 (3.71)	0.140^{T}
U1.NA (°)	22.52 (9.53)	24.94 (7.18)	0.402^{T}
U1.PP (°)	113.64 (10.10)	112.24 (6.90)	0.639^{T}
L1.NB (°)	31.81 (8.88)	27.68 (7.71)	0.144^{T}
FMIA (°)	57.46 (12.50)	57.39 (9.87)	0.985^{T}
Interincisal angle U1-L1 (°)	122.46 (10.89)	124.09 (8.52)	0.624^{T}

* ^{T} independent t test; $^{\alpha}$ chi-square test

* Statistically significant for p<0.05

Table 2. Results of intragroup comparison of the initial and final smile attractiveness (dependent t test).

Smile attractiveness	Initial (T1)		Final (T2)		p
	Mean	SD	Mean	SD	
SFA	3.79	1.68	6.10	1.72	**0.009***
CTOS	3.37	1.56	5.06	1.62	**0.000***

* Statistically significant for p<0.05

Table 3. Results of intergroup comparison of the smile attractiveness (independent t test).

Smile attractiveness	GROUP 1 SFA		GROUP 2 CTOS		p
	Mean	SD	Mean	SD	
Initial (T1)	3.79	1.68	3.37	1.56	**0.009***
Final (T2)	6.10	1.72	5.07	1.65	**0.000***
Treatment changes (T2-T1)	2.30	1.38	1.69	0.69	**0.000***

* Statistically significant for $p<0.05$

Table 4. Results of comparability of the groups of evaluators.

Variables	**Laypeople N=79**	**Maxillofacial surgeons N=34**	**Orthodontists N=92**	**P**
	Mean (SD)	**Mean (SD)**	**Mean (SD)**	
Age (years)	34.99 (9.76)	35.79 (10.03)	37.27 (9.21)	0.302 ^{O}
Sex				X^2 =26.37
Female	55	6	41	DF=2
Male	25	28	50	p=**0.000*** $^{\alpha}$

* Statistically significant for p<0.05
^{O} One-way ANOVA and Tukey test
$^{\alpha}$ chi-square test

Table 5. Comparison of the three groups of evaluators (one-way ANOVA and Tukey test).

Smile attractiveness	**Laypeople N=79**	**Maxillofacial surgeons N=34**	**Orthodontists N=92**	**P**
	Mean (SD)	**Mean (SD)**	**Mean (SD)**	
Initial (T1)	3.28 (1.80) ^{A}	3.58 (1.57) ^{A}	4.31 (1.47) ^{B}	**0.000***
Final (T2)	5.55 (1.88) ^{B}	6.48 (1.58) ^{A}	6.44 (1.49) ^{A}	**0.001***

* Statistically significant for $p<0.05$

Different letters in a row indicate the presence of a statistically significant difference between the groups.

Table 6. Results of intergroup of treatment time, %PAR and OGS (independent t test)

	GROUP 1 SFA		GROUP 2 CTOS		p
	Mean	**SD**	**Mean**	**SD**	
Treatment time	12.96	6.26	36.93	15.30	**0.000***
% PAR	96.28	7.09	59.62	27.58	**0.000***
OGS	12.40	3.54	22.53	6.10	**0.000***

* Statistically significant for p<0.05

Table 7 Spearman correlation comparing the variable surgical modality with the variables OGS, %PAR and final attractiveness of smile

	OGS	**%PAR**	**Final smile**
Surfical Modality	.691**	-.817**	-.320*
p	.000	.000	.004

**The correlation is significant in level .001
* The correlation is significant in level .005

3 DISCUSSION

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The attractiveness of the profile has been the motivation for many researchers to provide scientific support to clinicians, using different methodologies to comparison.(Vargo, Gladwin et al. 2003, Johnston, Hunt et al. 2010, Naini, Donaldson et al. 2012, Naini, Donaldson et al. 2012, Patcas, Bernini et al. 2019, Bou Wadi, Freitas et al. 2020) Furthermore, the self-perception of patients with dentofacial deformities has a negative influence on the degree of happiness, self-confidence and beauty, including an attractive profile, may be related to greater professional and personal success.(Kiekens, Maltha et al. 2006, Johnston, Hunt et al. 2010)

The main reasons for patients with dentofacial deformities to seek ortho-surgical treatment are esthetic, functional, and self-steam.(Rivera, Hatch et al. 2000, Stirling, Latchford et al. 2007, Gasperini, da Costa Andrade et al. 2019) Although there is controversy when this topic is involved, (Proothi, Drew et al. 2010, Patcas, Cunningham et al. 2017) most of the research corroborate that the esthetic is the main reason.(Patcas, Cunningham et al. 2017, Gasperini, da Costa Andrade et al. 2019) The patients with dentofacial deformities were less happy when compared with patients without dentofacial appearance with their dental appearance, especially women with Class II malocclusion. The shape and dental protrusion of teeth were the most frequent causes of concern.(Johnston, Hunt et al. 2010)

On the other hand, the return of SFA and MPOP as another treatment option, even though it is still a topic that generates a certain controversy among ortho-surgical teams.(Wei, Liu et al. 2018) Although for us seemed obvious, that most cases could be treated starting with surgery or performing a quick orthodontics, eliminating small compensations and controlling the spee curve and then eliminate the compensations with skeletal anchorage, with the same esthetic in the profile, corroborating the results of this study.(Sugawara, Nagasaka et al. 2018, Beccuti, Cozzani et al. 2021)

This question depends on a series of factors such as interaction between the team of surgeons and orthodontists, the technical skill of the surgeon in performing different osteotomies, the clinical skill of the orthodontist and knowledge of orthodontic biomechanics and handling of 3D software for surgery and orthodontics and

communication between this software.(Janakiraman, Feinberg et al. 2015, Tran, Tantidhnazet et al. 2018, Elshebiny, Morcos et al. 2019, Chen, Mo et al. 2021) Some authors report that SFA guidelines are indicated in cases where they do not have great dental compensation, with an interincisal angle close to normal, flat or slightly deepened curve, the transversal relationship of the Class I arches, and there can be no major discrepancies and the expertise of ortho-surgical team like discussed above. The guidelines to SFA they are worthy of discussion because they depend on the above factors and on the patient's opinion.(Liou, Chen et al. 2011, Gandedkar, Chng et al. 2016)

The results with better profile attractiveness in cases treated with SFA may seem like a bias. But for us this is a very clear issue because our approach is orthodontic-surgical driven, where surgical movements are greater and dental compensations are removed after orthodontic treatment. The fact that CTOS is linked to the completion of a Class I occlusal relationship can limit the surgeon and, consequently, the esthetic results in the profile. Sugawara et al. 2018 perform an orthodontic-driven approach with most cases treated with one-jaw approach, which could influence facial attractiveness,(Nagasaka, Sugawara et al. 2009, Sugawara, Nagasaka et al. 2018), and Hernández-Alfaro et al. 2014 perform a SFA approach with surgery-driven approach, therefore they perform SFA in limited cases because their team operate based on Class I occlusion.(Hernández-Alfaro, Guijarro-Martínez et al. 2014) All the cases were treated by SFA with orthodontic decompensation described by Faber et al. (Faber, Miranda et al. 2018) and Pereira et al. 2019 (Pereira, Moura et al. 2019)which in our view increases the esthetic possibilities and the possibility of treating more patients with this approach.

In this study the SFA group presented smiles more attractive than CTOS group, although both groups presented a great improvement. One of the issues can be explained by the best results in how much the occlusion improvement (final PAR index) when compared with CTOS group (Table 7). Previous articles demonstrated that the ideal score of final PAR index should be shorter than score 7 and we can observe a great difference between the groups.(Freitas, Freitas et al. 2008, Janson, Branco et al. 2014) This issue can be explained because the CTOS sample is treated with a more traditional approach, depending on greater patient cooperation. All the patients treated with SFA received four miniplates, which facilitate movements in the three planes of

space without depending on the patient's cooperation.(Sugawara, Nagasaka et al. 2018)

Another factor that could affect the smile attractiveness in orthodontics and ortho-surgical treatment is the quantity of gingival display demonstrating that a smile with ± 4mm is less unattractive in the opinion of orthodontists, dentists, and laypeople.(Al Taki, Hayder Mohammed et al. 2017) Furthermore, esthetic can be affected by level of education, social status, (Tosun and Kaya 2020)and culture.(Al Taki, Hayder Mohammed et al. 2017) The most attractive gingival display it varies from 0 to +2mm of gingival display, with differences in the opinion of laypeople, dentists, orthodontists, and the orthodontists were more critical corroborated with our results.(Valverde-Montalva, Flores-Mir et al. 2021) Three of fifteen patients treated with CTOS yet presented a gingival above to 3mm after the orthognathic surgery, which it's considered less attractive between the orthodontists, dentists, and laypeople. (Al Taki, Hayder Mohammed et al. 2017){Valverde-Montalva, 2021 #2934

The soft tissue position has a significant level of contribution to the smile attractiveness. The curvature of the upper lip is classified as downward, straight, and upright, and the first one is considered the less unattractive.{Van der Geld, 2011 #2935}. The more downward with more gingival display, the less attractive the smile becomes.(Van der Geld, Oosterveld et al. 2011) A study demonstrated that the relationship between the lips before and after the orthognathic surgery became better compared with the pretreatment and the control group. The upper and lower lips on smiling moved significantly laterally and superiorly made the smile more attractive.(Islam, Kitahara et al. 2010)

Not least the curvature of the lower lip plays an important role in the attractiveness of the smile.(Tosun and Kaya 2020) In this study the laypeople preferred a smile with 2mm recovered the upper incisors and 2mm of exposition of lower incisors, while the orthodontists and preferred a smile with 0.5mm recovered the upper incisors and 0.5mm of exposition of lower incisors. Only one of the patients in the SFA group presented an inferior labial line bigger than 2mm and between the CTOS group four patients presented the lower lip bigger than 2mm, showing an unattractive exposure of the lower lip and consequently the attractiveness of smile.(Tosun and Kaya 2020)

Wei et al. related in systematic review and metanalysis that SFA have a postoperative tendency to counterclockwise rotation and poor stability. In this research the results are not corroborated with this metanalysis. Another question is that the studies included in this metanalysis are so much heterogeneous, the penultimate radiographs were performed immediately after surgery and must be immediately after debonding and we can't know if were used adequate biomechanics strategies to control this "relapse".(Jeong, Kim et al. 2014) Furthermore, the authors inserted SFA and MPOP in the same group, and this generates a big bias. If there was initial alignment and leveling, "the surgery is not more first". Other systematic reviews and metanalyses showed different results from the results found by Wei and collaborators.(Yang, Xiao et al. 2017, Soverina, Gasparini et al. 2019, Barone, Morice et al. 2020) However, these studies also present very heterogeneous studies. More robust studies, such as randomized clinical trials are necessary but difficult to carry out.

A recent study using another methodology found results that corroborate with our conclusions. Beccuti et al. 2021 found in a qualitative study that SFA and CTOS had the same quantity of satisfaction but with less treatment time and immediate profile improvement. The limitations of this study are the retrospective sample and the treatment performed by different teams. Many studies with more homogenous samples, randomized clinical trials or quasi-randomized clinical trials need to be performed.

In summary, the literature has a lack of studies comparing the influence of teeth and lips in macro and micro esthetics combined with orthognathic surgery. Many variables influence the smile attractiveness, mainly in patients with dentofacial and the ortho-surgical teams need to be attempted to all these factors.

4 CONCLUSION AND FINAL CONSIDERATIONS

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In this study the SFA show better results in attractiveness of smile and profile with better quality of finishing than COS group. SFA has become a good alternative for patients, maxillofacial surgeons, and orthodontists with shorter treatment time.

The ideal design of this study was a randomized clinical trial with the same ortho-surgical team with expertise in both modalities. Thus, various biases could be eliminated, and higher levels of scientific evidence could be evaluated by clinicians.

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ANNEXES

PARECER CONSUBSTANCIADO DO CEP

DADOS DA EMENDA

Título da Pesquisa: Atratividade do perfil e do sorriso após tratamento ortodôntico-cirúrgico convencional e com benefício antecipado

Pesquisador: Pedro Graziani Olímpio Pereira

Área Temática:

Versão: 3

CAAE: 51458521.6.0000.5417

Instituição Proponente: Universidade de Sao Paulo

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 5.144.753

Apresentação do Projeto:

Trata-se de uma tese de doutorado que irá avaliar documentações de pacientes tratados a mais de 10 anos, que constituem acervo particular de consultórios localizados nas cidades de Belém – PA, Brasília – DF, Bauru – SP. Realizar-se-á avaliação da atratividade do sorriso e do perfil por meio de um website. Serão selecionados prontuários e modelos, de gesso ou por impressão 3D, de pacientes tratados ortodônticocirurgicamente, pelos protocolos de Cirurgia Ortognática Convencional de Três Fases (COCTF) e por Cirurgia.

Objetivo da Pesquisa:

O objetivo primário desta pesquisa será comparar (1) a atratividade do perfil e (2) a atratividade do sorriso ao final do tratamento de pacientes tratados pela abordagem de Cirurgia Ortognática Convencional de Três Fases (COCTF) e de Benefício Antecipado (COBA).

Avaliação dos Riscos e Benefícios:

Estão adequados.

Comentários e Considerações sobre a Pesquisa:

Trata-se de emenda para correção sobre financiamento do estudo.

Considerações sobre os Termos de apresentação obrigatória:

Estão adequados.

Endereço: DOUTOR OCTAVIO PINHEIRO BRISOLLA 75 QUADRA 9
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ANNEXES

ANNEX A – Research Institutional Board approval, protocol number 51458521.6.0000.5417.

USP - FACULDADE DE ODONTOLOGIA DE BAURU DA USP

Continuação do Parecer: 5.144.753

Recomendações:

Não se aplica.

Conclusões ou Pendências e Lista de Inadequações:

Emenda aprovada sem restrições de ordem ética.

Considerações Finais a critério do CEP:

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ANNEX B – 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

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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