Maurits de Ruiter, MKA-chirurg

Symposium Sleepless Vivisol
Tandheelkundige Slaapgeneeskunde

Landgoederij Bunnik, 15 mei 2025

mdruiter@diakhuis.nl

Diakonessenhuis

CV

- Tandarts: Radboud University Nijmegen
- Arts: Amsterdam University Medical Center
- MKA-opleiding: Amsterdam University Medical Center

Present: OMF surgeon in Diakonessenhuis Utrecht/Zeist and University Medical Center Utrecht

Disclosure belangen sprekers

Disclosure belangen spreker	
Geen (potentiële) belangenverstrengeling	Geen/ Zie hieronder
Voor bijeenkomst mogelijk relevante relaties[1]	VIVISOL Nederland B.V.
• Sponsoring of onderzoeksgeld[2] • Honorarium of andere (financiële) vergoeding[3] • Aandeelhouder[4] • Andere relatie, namelijk …[5]	Onderzoeksbeurs Diakonessenhuis Ja N.v.t. N.v.t.

No conflict of interest

Diakonessenhuis

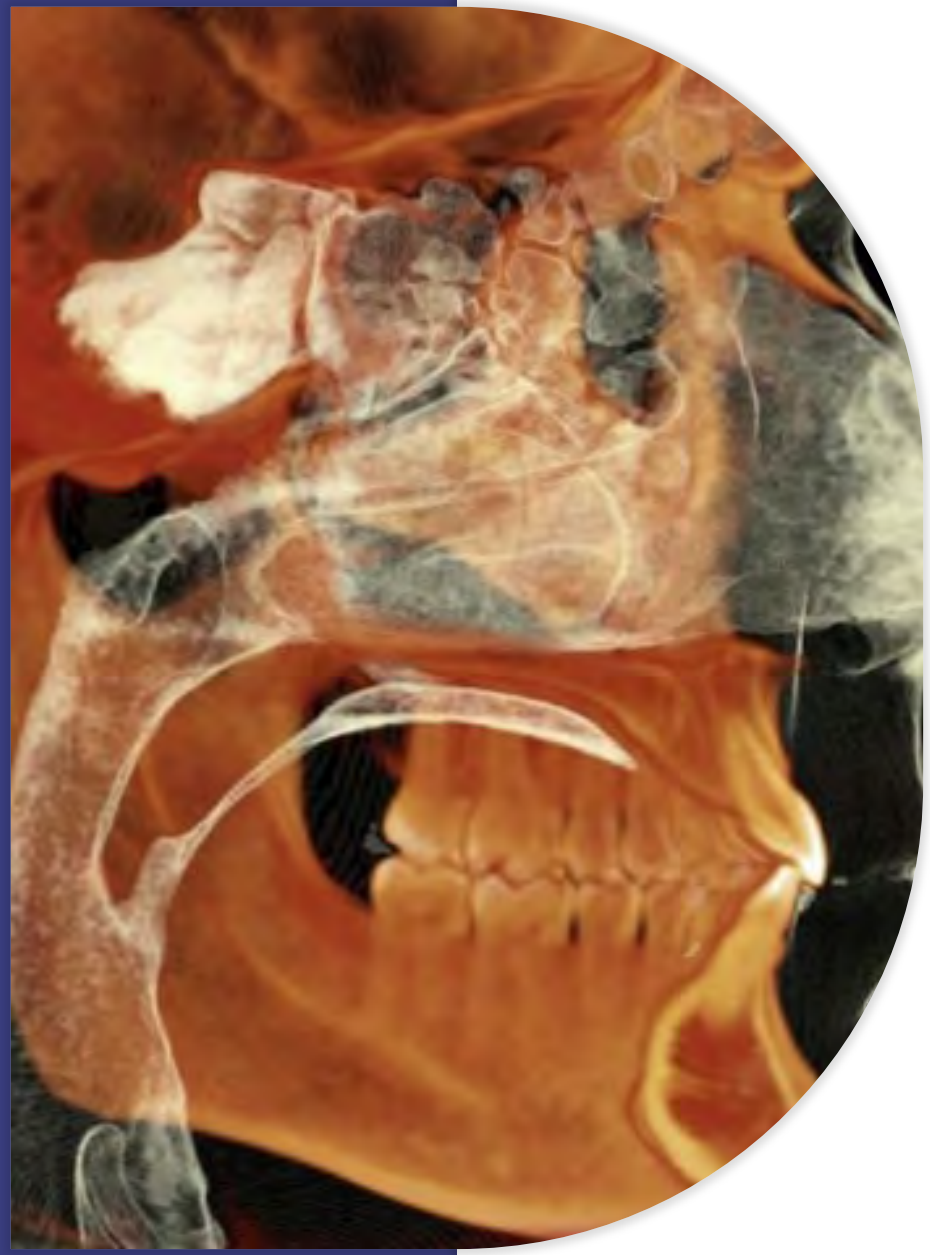
NEELTJE

Diakonessenhuis

YFKE

Diakonessenhuis

WILLEM



Learning Objectives

1. Wat is Tandheelkundige Slaapgeneeskunde?

2. Mandibulair repositie apparaat (MRA)

3. De kaakoperatie (bimax of MMA)

Kijktip!

https://www.maxvandaag.nl/sessies/themas/media-cultuur/max-masterclass-slaapexpert-els-van-der-helm-over-het-belang-van-goede-nachtrust/

Diakonessenhuis

PATIENT

Hoofdklacht!!!!!

SNORING	APNOEA	CVD	HEADACHE
TIREDNESS / SLEEPINESS	CONCENTRATION	DEPRESSION / PSYCH	ABILITY TO DRIVE

PATIENT

CHARACTERISTICS

- GENDER
- AGE
- BODY WEIGHT
- COMORBIDITY
- MEDICATION
- RELATION - PARTNER
- JOB – DAILY FUNCTIONING
- STRESS - PSYCH

KNO onderzoek

- Neuspassage
- Tonsillen
- Tong (positie, grootte) → Mallampati score
- Nekomtrek

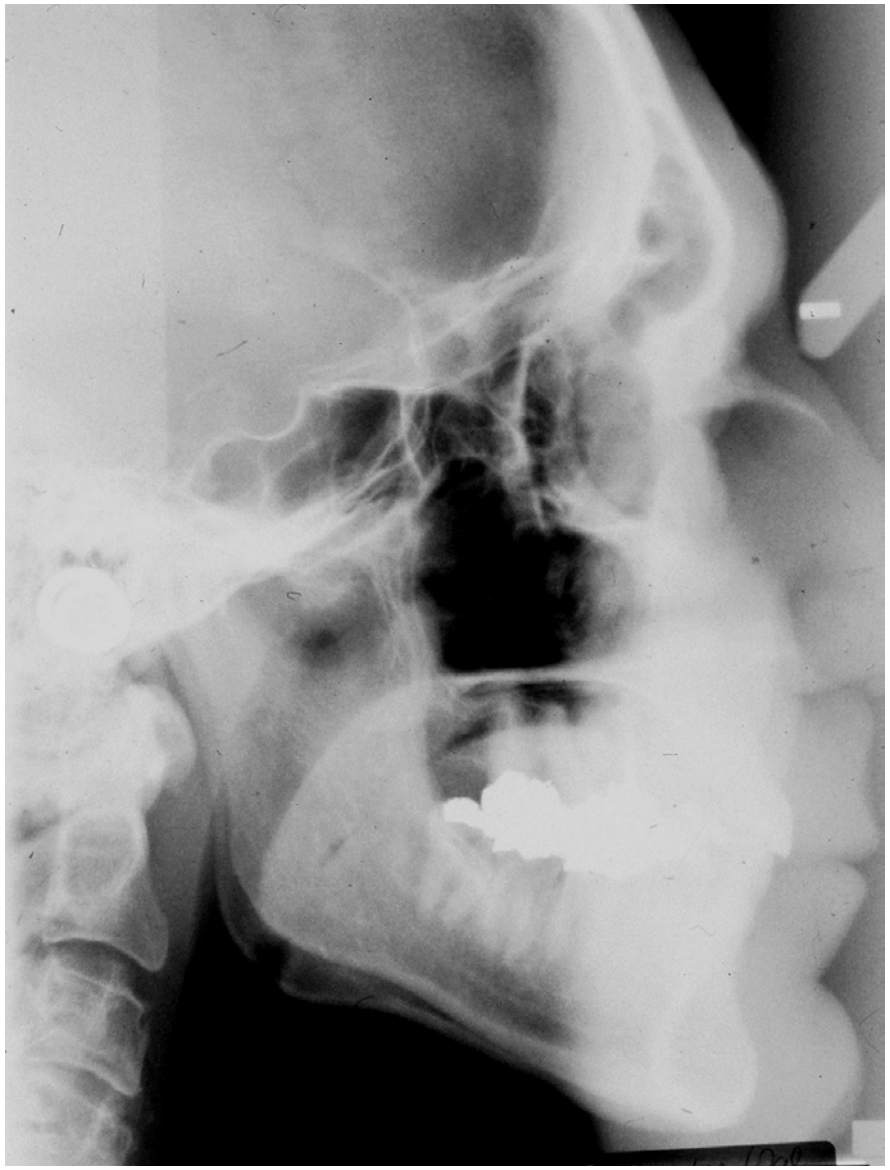
Tandheelkundig onderzoek

- Tanden / dentitie
  - Pathologie; caries / parodontitis?
  - Dental fit?

- Temporomandibular Joint

- Tandheelkundig behandelplan?

- Heeft u een goed gebit?
- Is de tandarts tevreden?
- Gaat u regelmatig naar de tandarts?




HO,J.P.T.,
PMKC
28-08-2014

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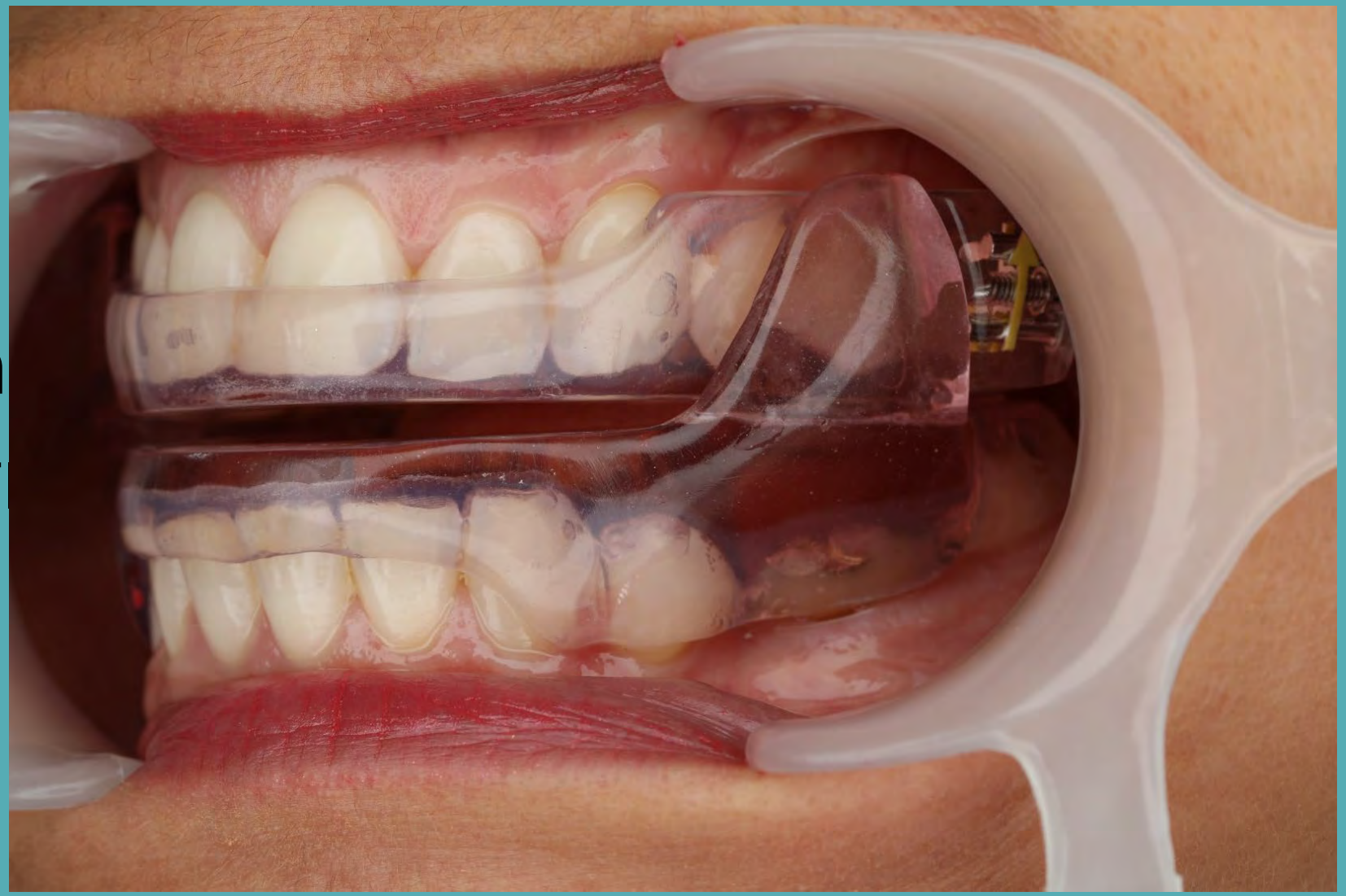
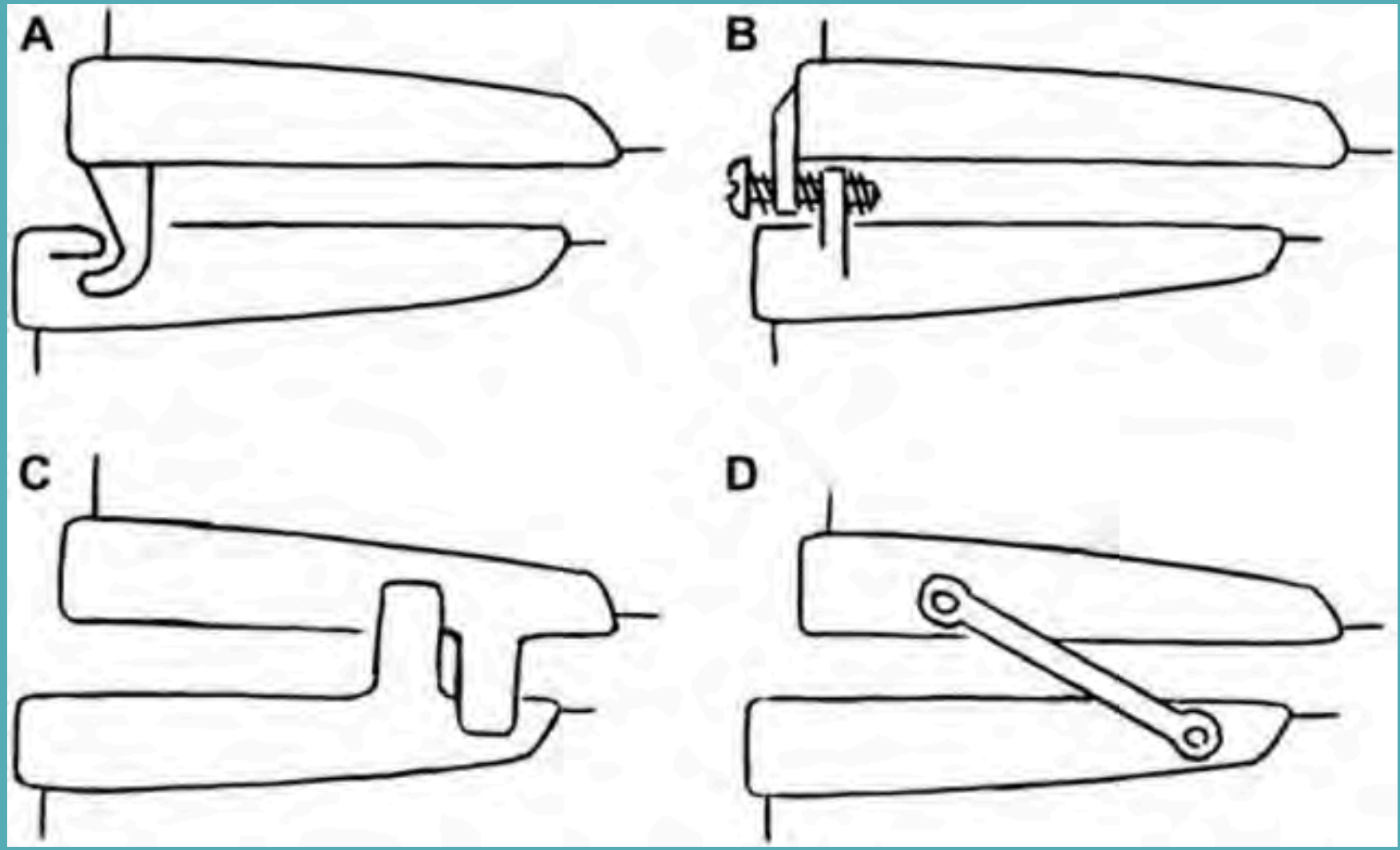



A
B
C
D

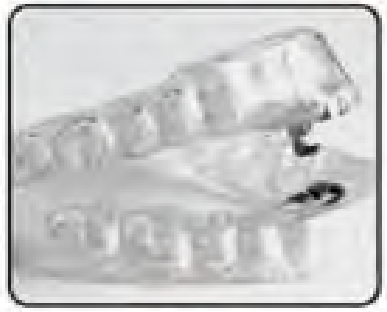
Somnomed
Prosomnus
Resmed

Types of Oral Appliances for Obstructive Sleep Apnea

Klearway

Somnomed

Herbst



Tap

Suad


SomnoDenf


ORTOPLUS


SnoreEx


SnoreEx

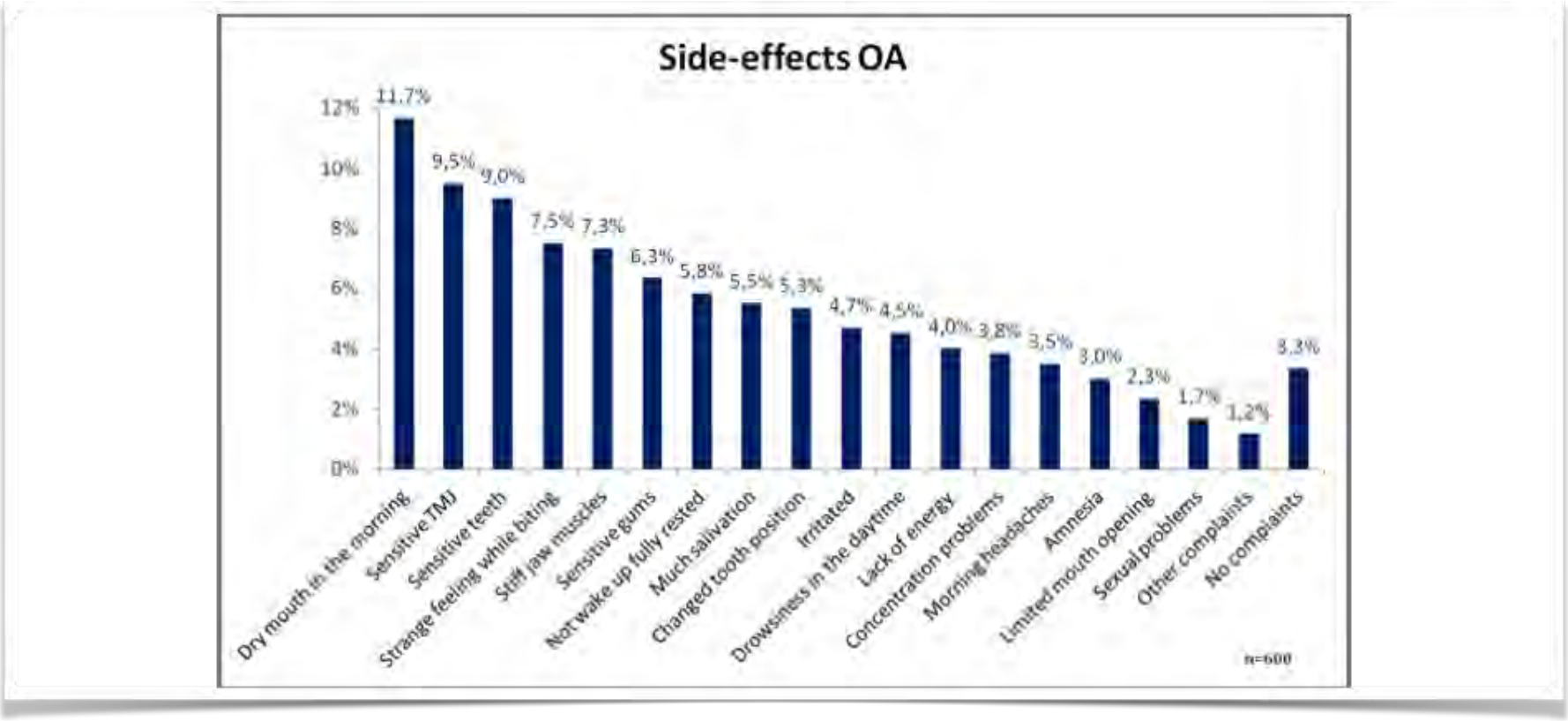

SnoreX

Snorex

https://www.youtube.com/watch?v=BQksW4h9V1s&feature=youtu.be

Ten slotte wordt opgemerkt dat er naast het MRA nog andere “oral appliances” voor de behandeling van OSAS bestaan. Het “tongue-retaining device” (TRD) is ontworpen om de tong ter verbetering van de luchtwegdoorgankelijkheid in een voorwaartse stand te fixeren. Het effect van dit apparaat op de AHI is echter niet significant (Barthlen, 2000]. “Mouth shields” en “soft palate-lifting devices” zijn ervoor bedoeld om snurkgeluiden tegen te gaan, maar zijn bij OSAS niet effectief (Schönhofer, 1997]. Bij een apparaat dat de tong ter verbetering van de luchtpassage naar voren houdt is de patiëntcompliantie bijzonder slecht (Schönhofer, 1997]. Op grond van de literatuur moet een behandeling van OSAS-patiënten met “oral appliances” die de onderkaak niet in een voorwaartse stand fixeren vanwege de slechte behandelingsresultaten worden afgeraden.

CBO Richtlijn 'Diagnostiek en behandeling van obstructieveslaapapneusyndroom bij volwassenen' 2009.



cohort trial, 326 patients, 167 (51%) used questionnaires. de Ruiter et al 2016

Side Effects

Dry mouth
Sensitive TMJ
Sensitive teeth
Stiff muscles
Changed tooth position

MRA aantallen

- 2018: 3 (flex)
- 2019: 67 (flex en fusion)
- 2020: 123 (flex, fusion)
- 2021: 185 (fusion en avant)
- 2022: 213
- 2023: 255

Ook bij patiënten zonder tanden/kiezen en een kunstgebit (edentate patiënten met bv implantaten)

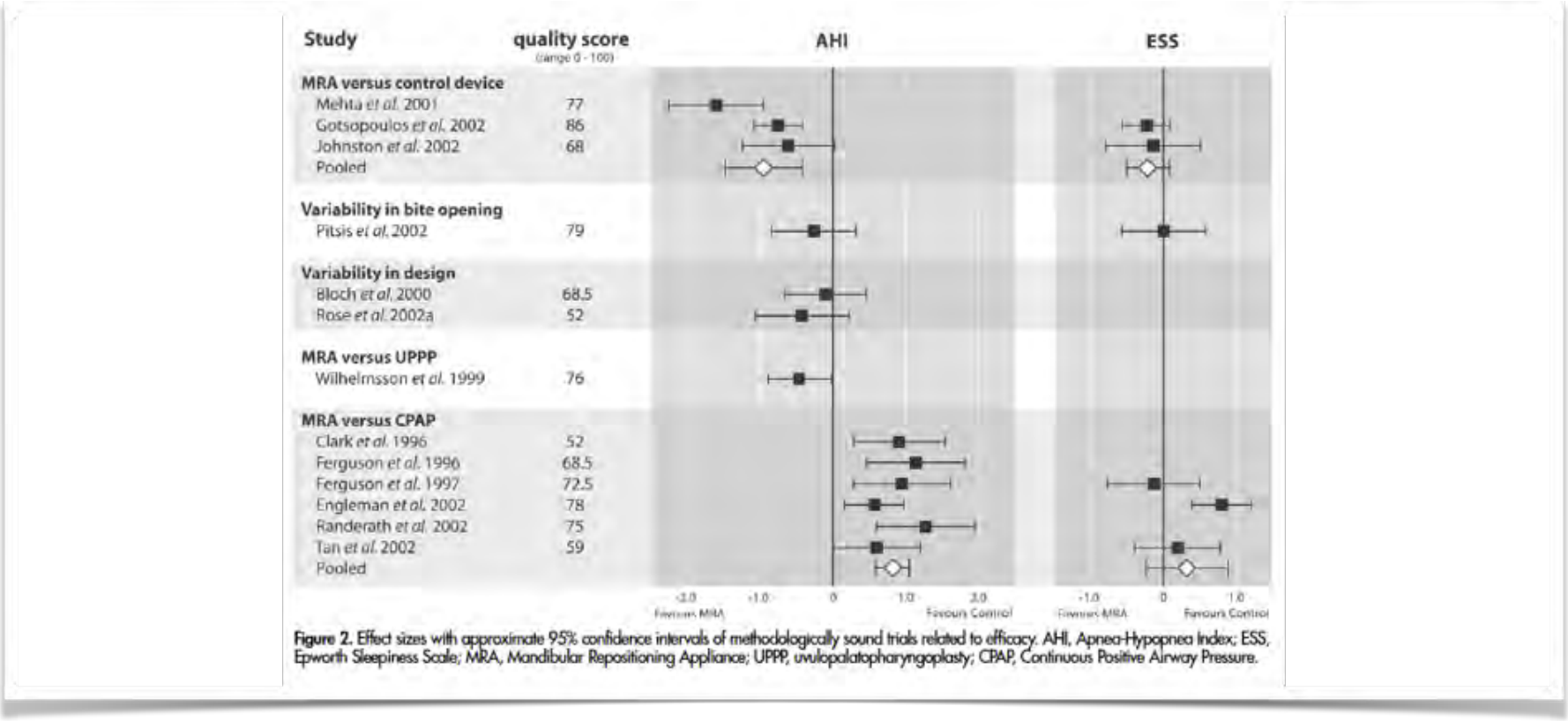


Figure 2. Effect sizes with approximate 95% confidence intervals of methodologically sound trials related to efficacy. AHI, Apnea-Hypopnea Index; ESS, Epworth Sleepiness Scale; MRA, Mandibular Repositioning Appliance; UPPP, uvulopalatopharyngoplasty; CPAP, Continuous Positive Airway Pressure.

Hoekema A, Stegenga B, De Bont LG. Efficacy and co-morbidity of oral appliances in the treatment of obstructive sleep apnea-hypopnea: a systematic review. Crit Rev Oral Biol Med 2004;15:137-55.

Efficacy

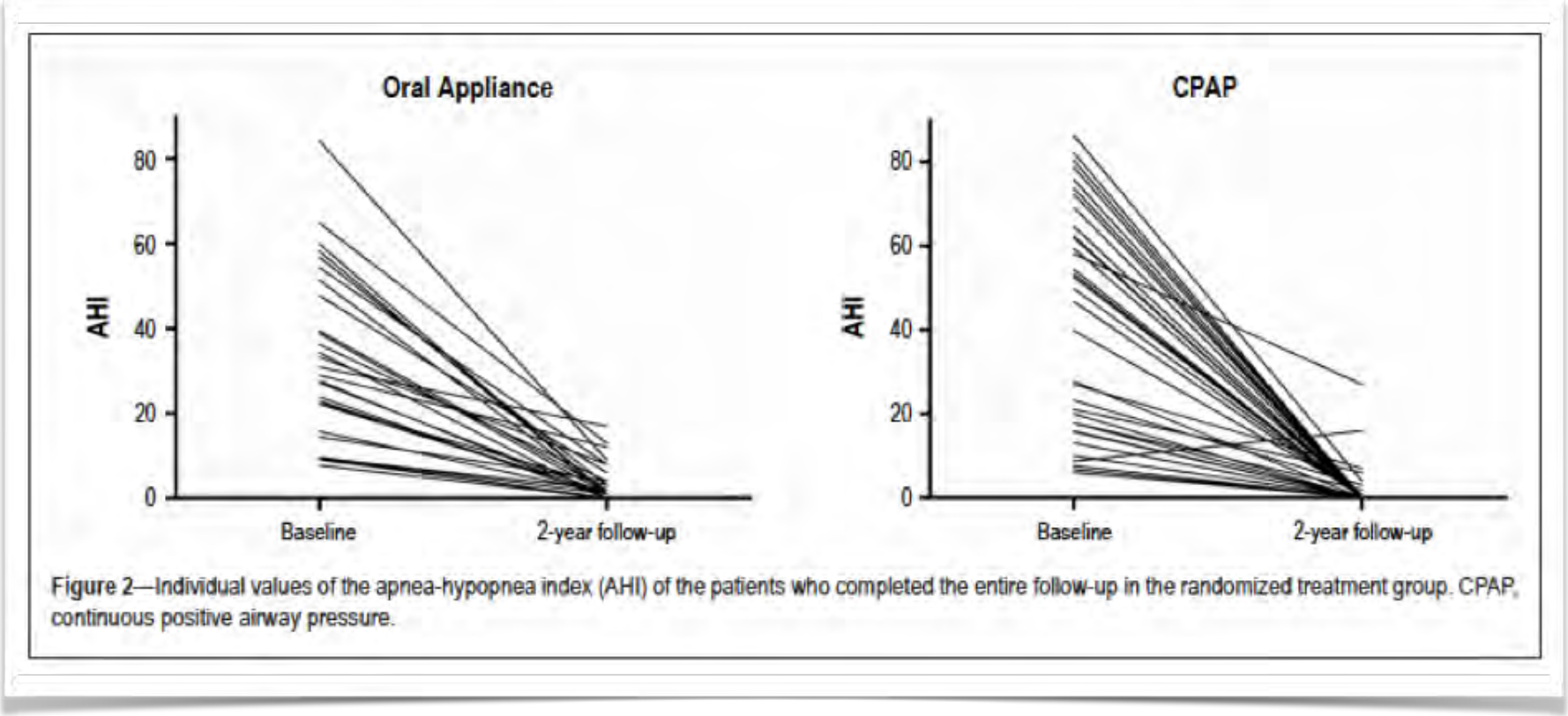


Figure 2—Individual values of the apnea-hypopnea index (AHI) of the patients who completed the entire follow-up in the randomized treatment group. CPAP, continuous positive airway pressure.

Doff, M. H., Hoekema, A., Wijkstra, P. J., van der Hoeven, J. H., Slater, J. J. H., de Bont, L. G., & Stegenga, B. (2013). Oral appliance versus continuous positive airway pressure in obstructive sleep apnea syndrome: a 2-year follow-up. Sleep, 36(9), 1289.

MRA vs CPAP

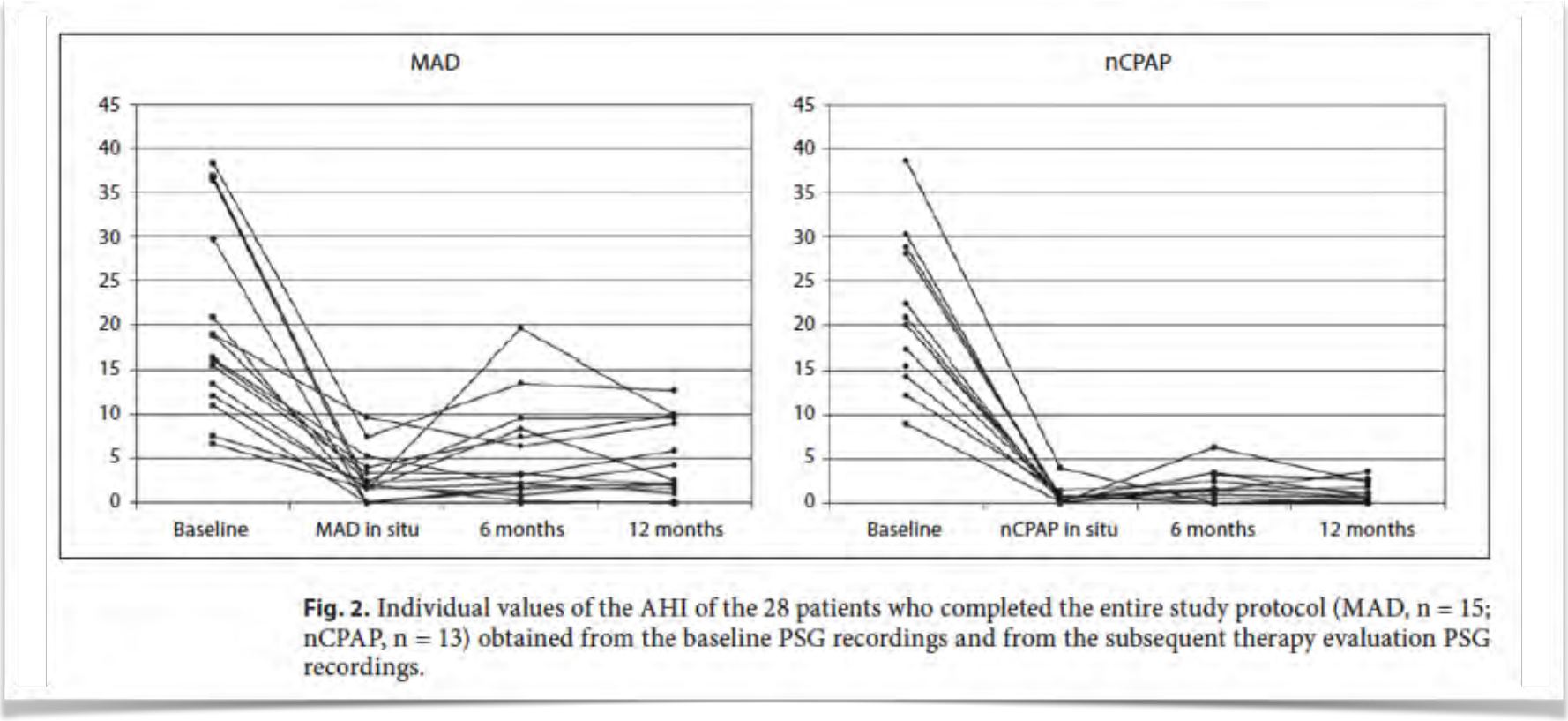
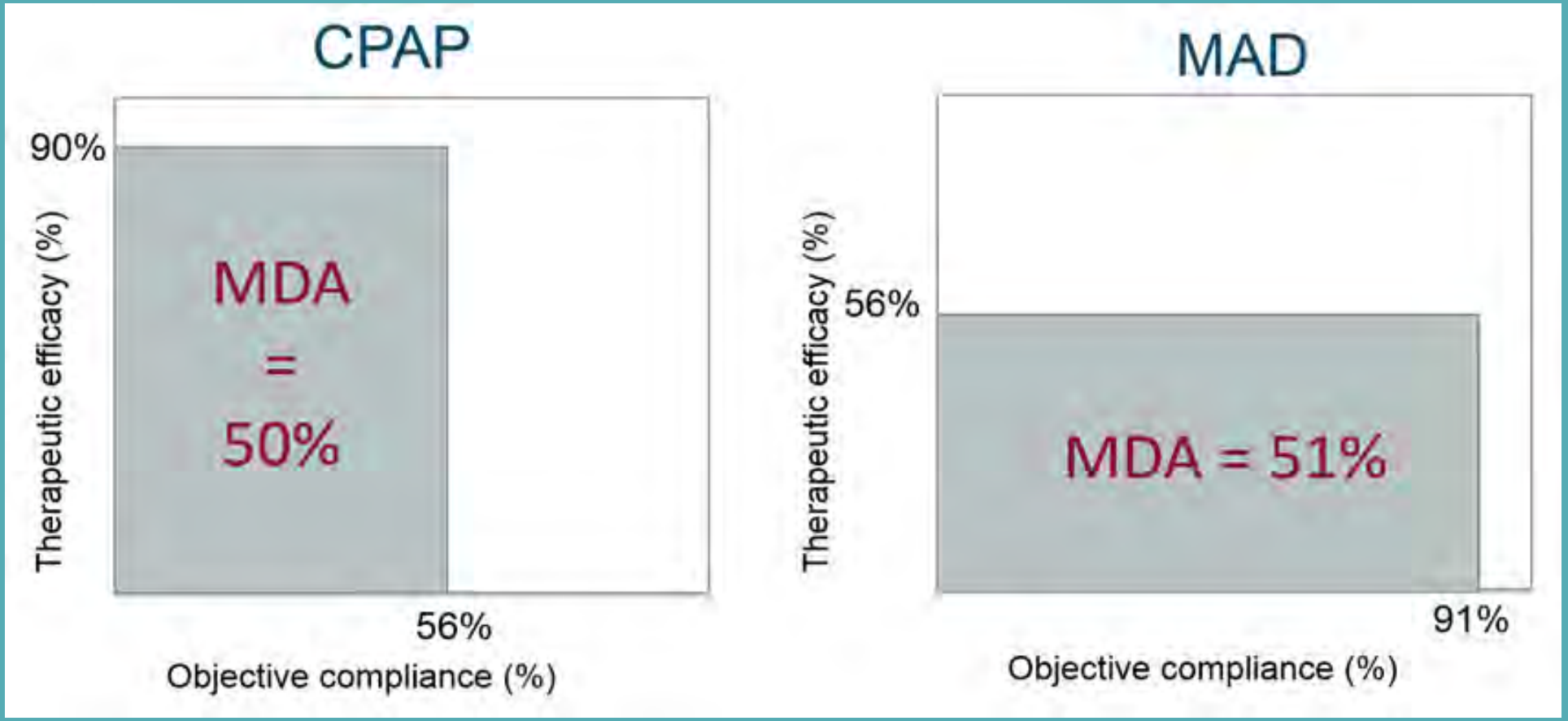


Fig. 2. Individual values of the AHI of the 28 patients who completed the entire study protocol (MAD, n = 15; nCPAP, n = 13) obtained from the baseline PSG recordings and from the subsequent therapy evaluation PSG recordings.

Aarab, G., Lobbezoo, F., Hamburger, H. L., & Naeije, M. (2010). Oral appliance therapy versus nasal continuous positive airway pressure in obstructive sleep apnea: a randomized, placebo-controlled trial. Respiration, 81(5), 411-419.

MRA vs nCPAP

Mean Disease Alleviation



Dieltjens, M., Braem, M. J., Vroegop, A. V., Wouters, K., Verbraecken, J. A., De Backer, W. A., ... & Vanderveken, O. M. (2013). Objectively measured vs self-reported compliance during oral appliance therapy for sleep-disordered breathing. *Chest*, *144*(5), 1495-1502.

Table 2 Overview of the polysomnographic characteristics of the study patients ($n = 36$) per titration position of OA

	Titration, 60%	Titration, 75%	Titration, 90%	*P* value
Baseline ($n = 36$)	($N = 36$)			
AHI	12.9 (9.1–16.7)	-	-	
ODI	10.0 (6.0–1.8)	-	-	
3-month follow-up ($n = 36$)	($N = 13$)	($N = 23$)	-	0.052
AHI	9.7 (5.1–14.8)	5.0 (3.4–9.4)	-	0.159
ODI	8.0 (4.0–12.0)	5.0 (3.0–8.0)		
12-month follow-up ($n = 29$)	($N = 3$)	($N = 15$)	($N = 11$)	
AHI	5.4 (5.0–5.4)	4.4 (2.9–6.6)	7.8 (4.0–14.7)	0.127
ODI	7.0 (6.0–7.0)	4.0 (2.0–8.0)	8.0 (7.0–16.0)	0.052

All patients started at baseline on 60% of maximum protrusive path

The table gives an overview of median (IQR25–75)

Differences between groups are significant (Kruskal-Wallis test $P < 0.05$)

de Ruiter, M. H. T., Aarab, G., de Vries, N., Lobbezoo, F., & de Lange, J. (2020). A stepwise titration protocol for oral appliance therapy in positional obstructive sleep apnea patients: proof of concept. *Sleep and Breathing*, 1-8.

Titration protocol

- Start at 60%
- Advance to 75% / 90%
- Subjective improvement
- Dental side-effects

Clin Oral Invest (2012) 16:689–697
DOI 10.1007/s00784-011-0555-6

ORIGINAL ARTICLE

Long-term oral appliance therapy in obstructive sleep apnea syndrome: a controlled study on temporomandibular side effects

Michiel H. J. Doff · Steffanie K. B. Veldhuis · Aarnoud Hoekema · James J. R. Huddleston Slater · P. J. Wijkstra · Lambert G. M. de Bont · Boudewijn Stegenga

Received: 2 December 2010 / Accepted: 14 April 2011 / Published online: 3 May 2011

Craniomandibular Dysfunction

Limitations

- Initial period: Pain related TMD: OAT 24% vs 6% CPAP
- No limitations in mandibular function
- Transient (persistent 10%)

Clin Oral Invest
DOI 10.1007/s00784-012-0737-x

ORIGINAL ARTICLE

Long-term oral appliance therapy in obstructive sleep apnea syndrome: a controlled study on dental side effects

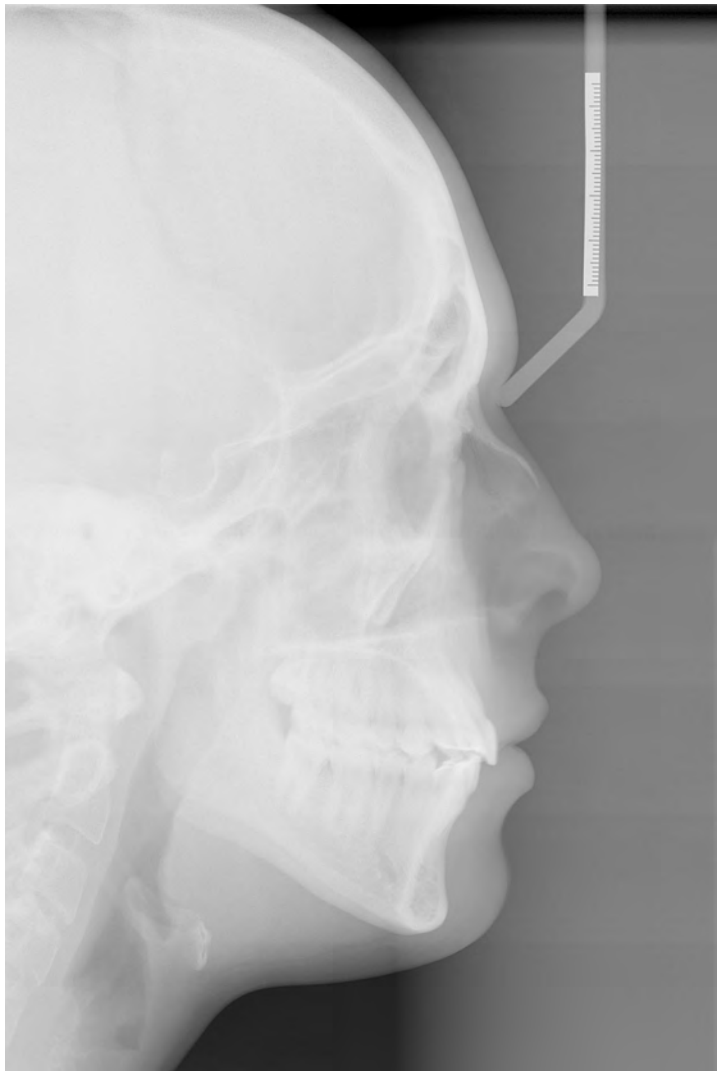
M. H. J. Doff · K. J. Finnema · A. Hoekema · P. J. Wijkstra · L. G. M. de Bont · B. Stegenga

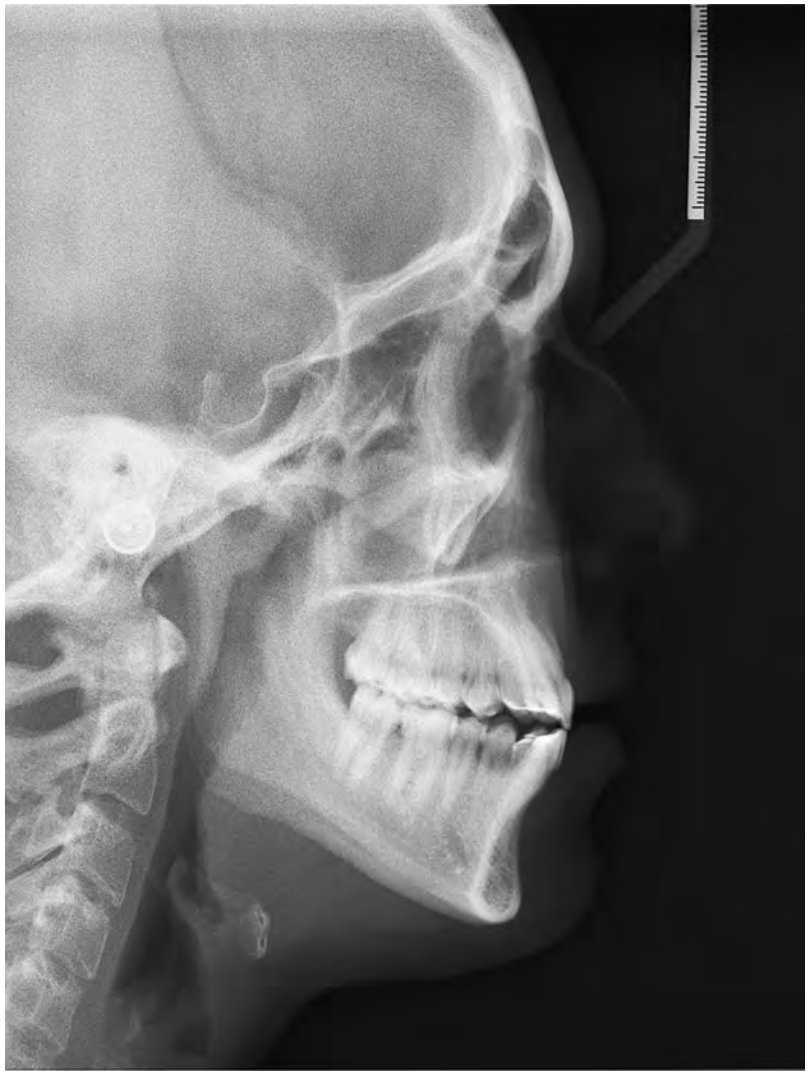
Received: 17 December 2011 / Accepted: 10 April 2012

Dental changes in OAT

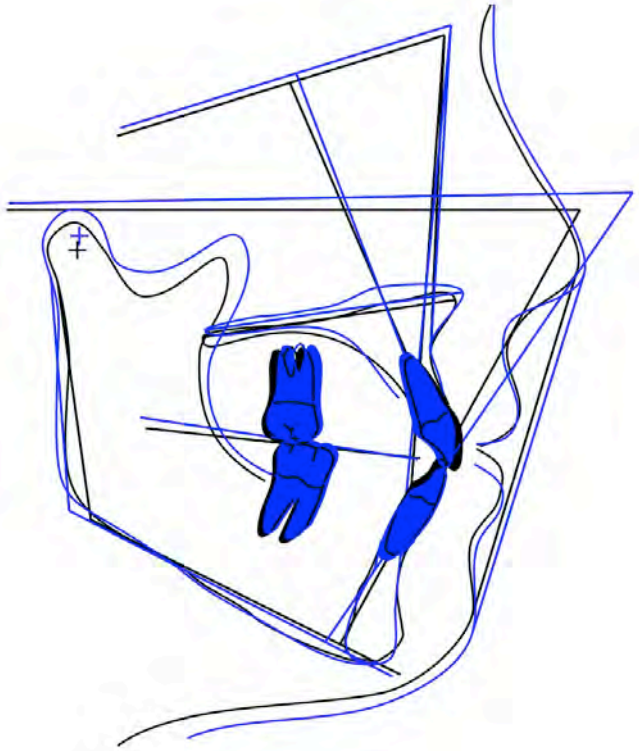
Limitations

- Overjet and overbite decreased 1.2 and 1.5 mm
- Open bite (posterior)



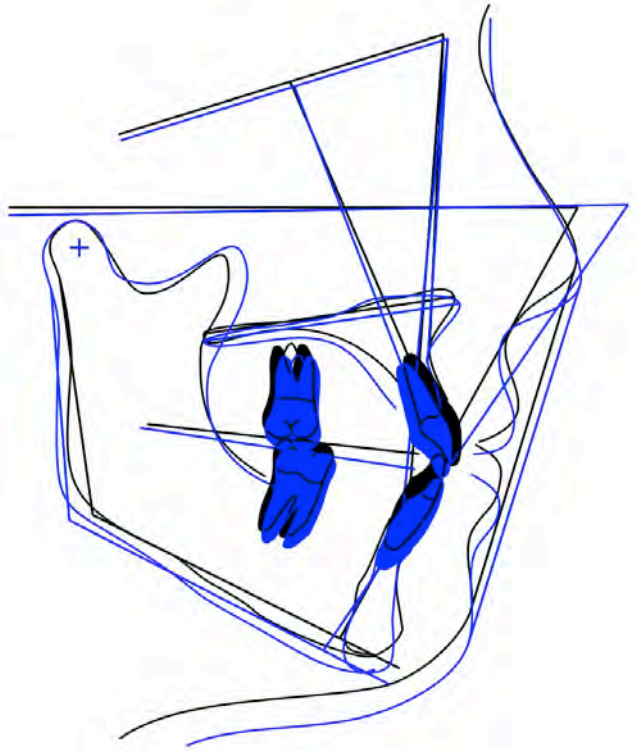


PNS-ANS@A-point (Auto)



2013
2016

PNS-ANS@Hinge Axis (Auto)

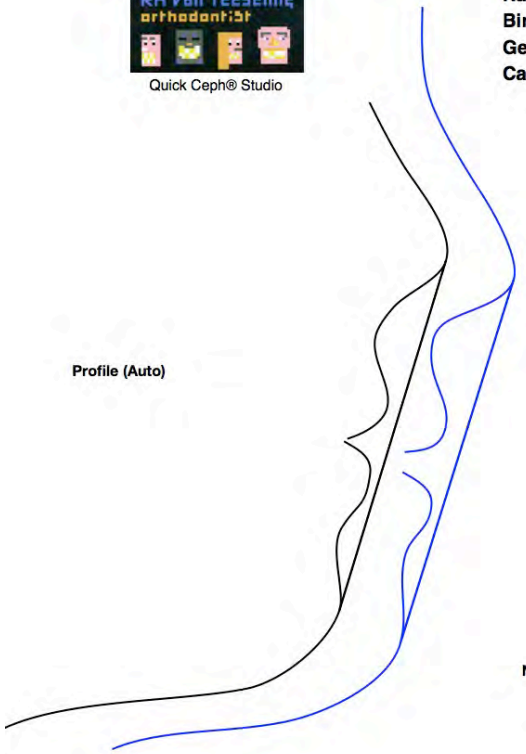


2013
2016

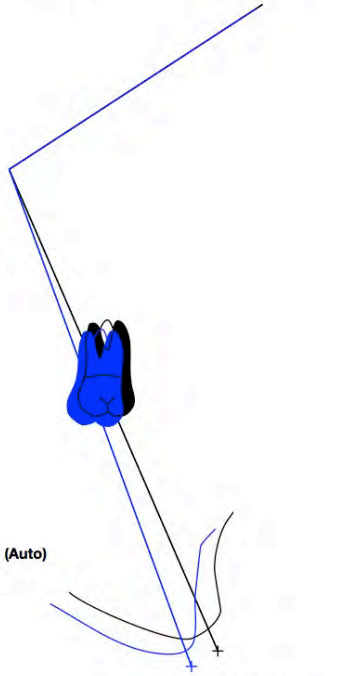
RA van Teeseling orthodontist

Quick Ceph® Studio

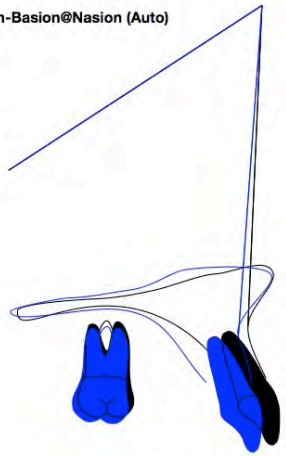
Name:	osas giessen			
Birth:	1980-12-12	**Status:**	2013	2016
Gender:	Male	**Record:**	2016-12-21	2016-12-21
Case:	00001	**Age:**	36yr 0mo	36yr 0mo



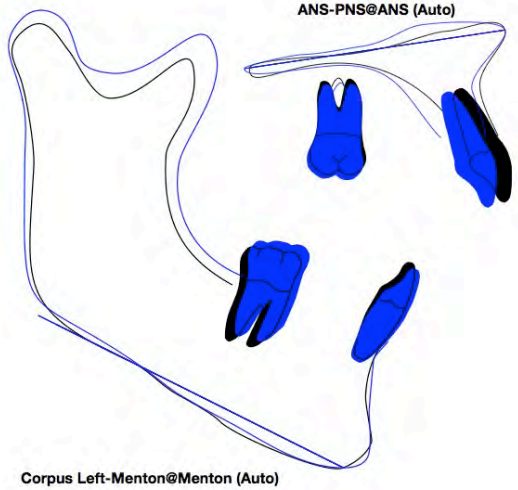
Profile (Auto)



Nasion-Basion@CC (Auto)

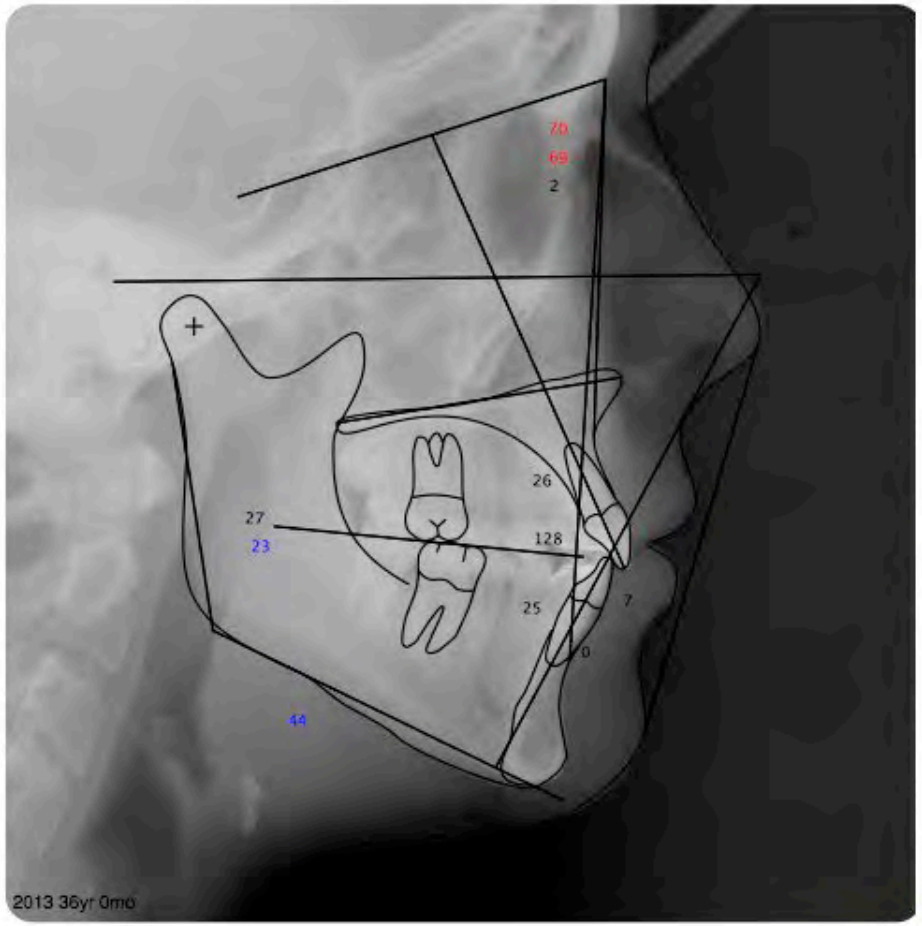


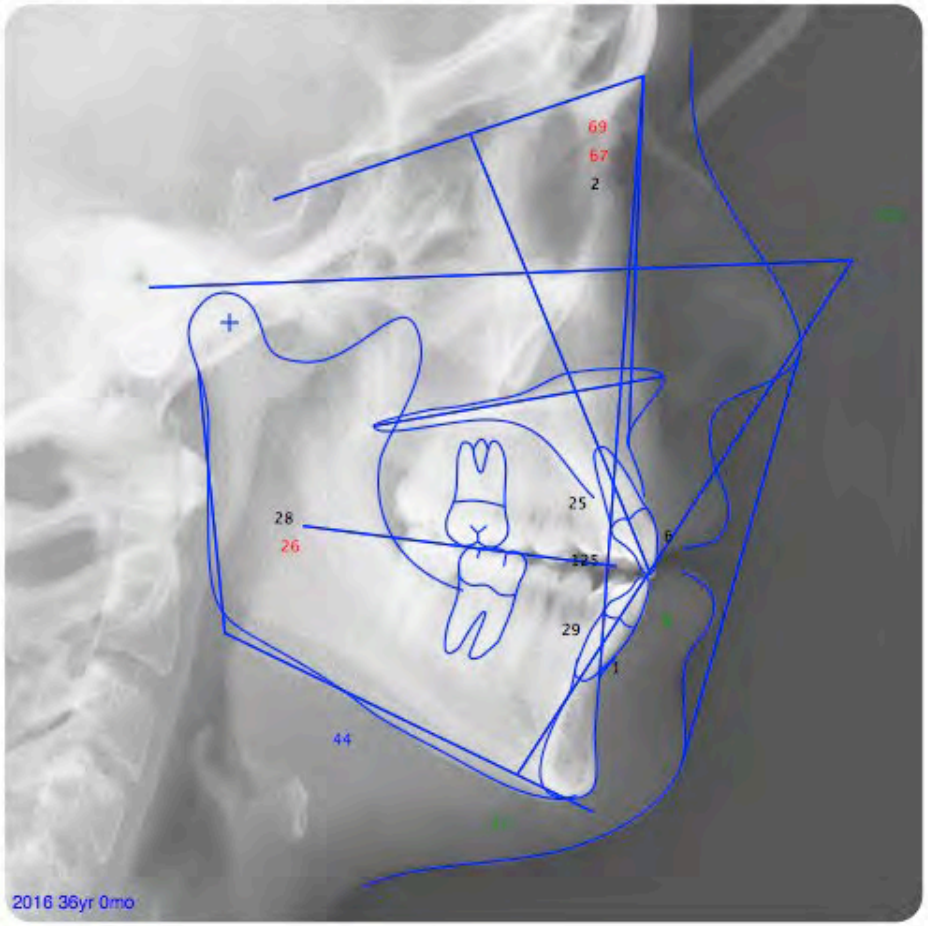
Nasion-Basion@Nasion (Auto)



ANS-PNS@ANS (Auto)

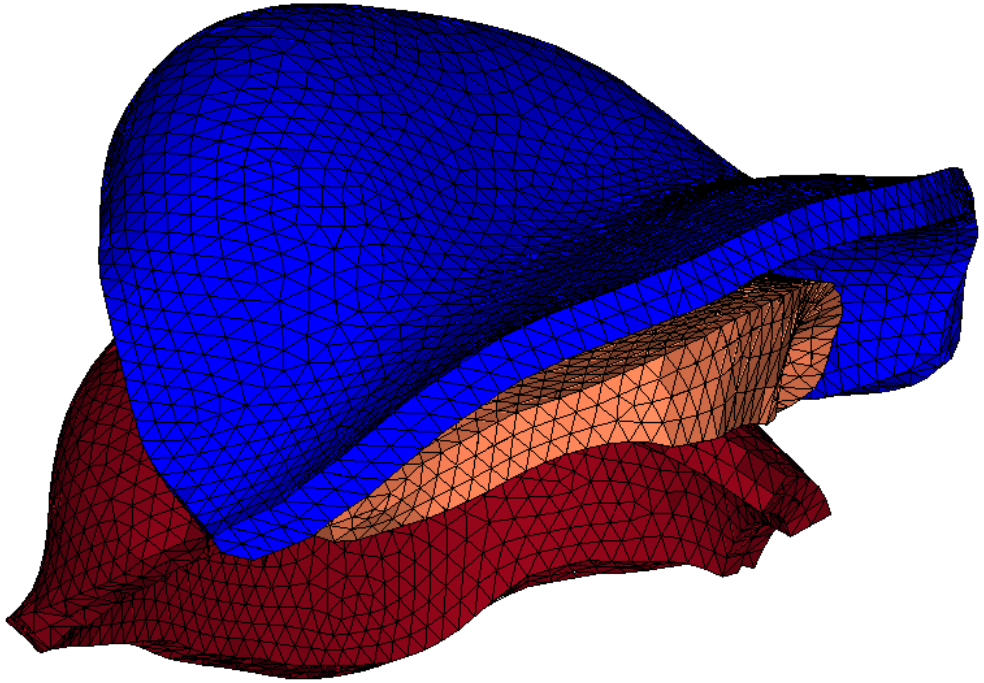
Corpus Left-Menton@Menton (Auto)


70
69
2
26
27
23
128
25
7
0
44
2013 36yr 0mo


69
67
2
28
26
25
6
125
29
1
44
2016 36yr 0mo

Temporomandibular Aspects in MAD treatment

Finite element model

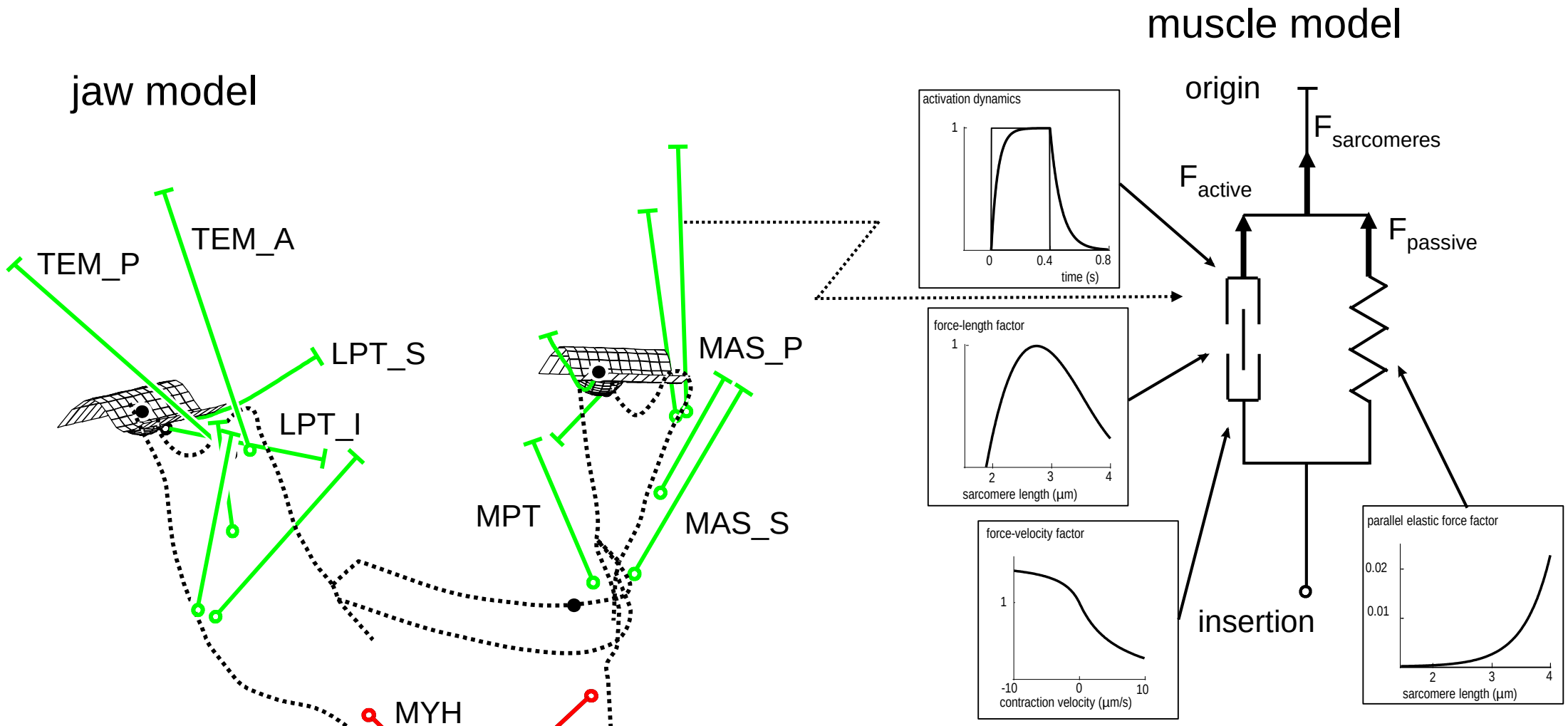


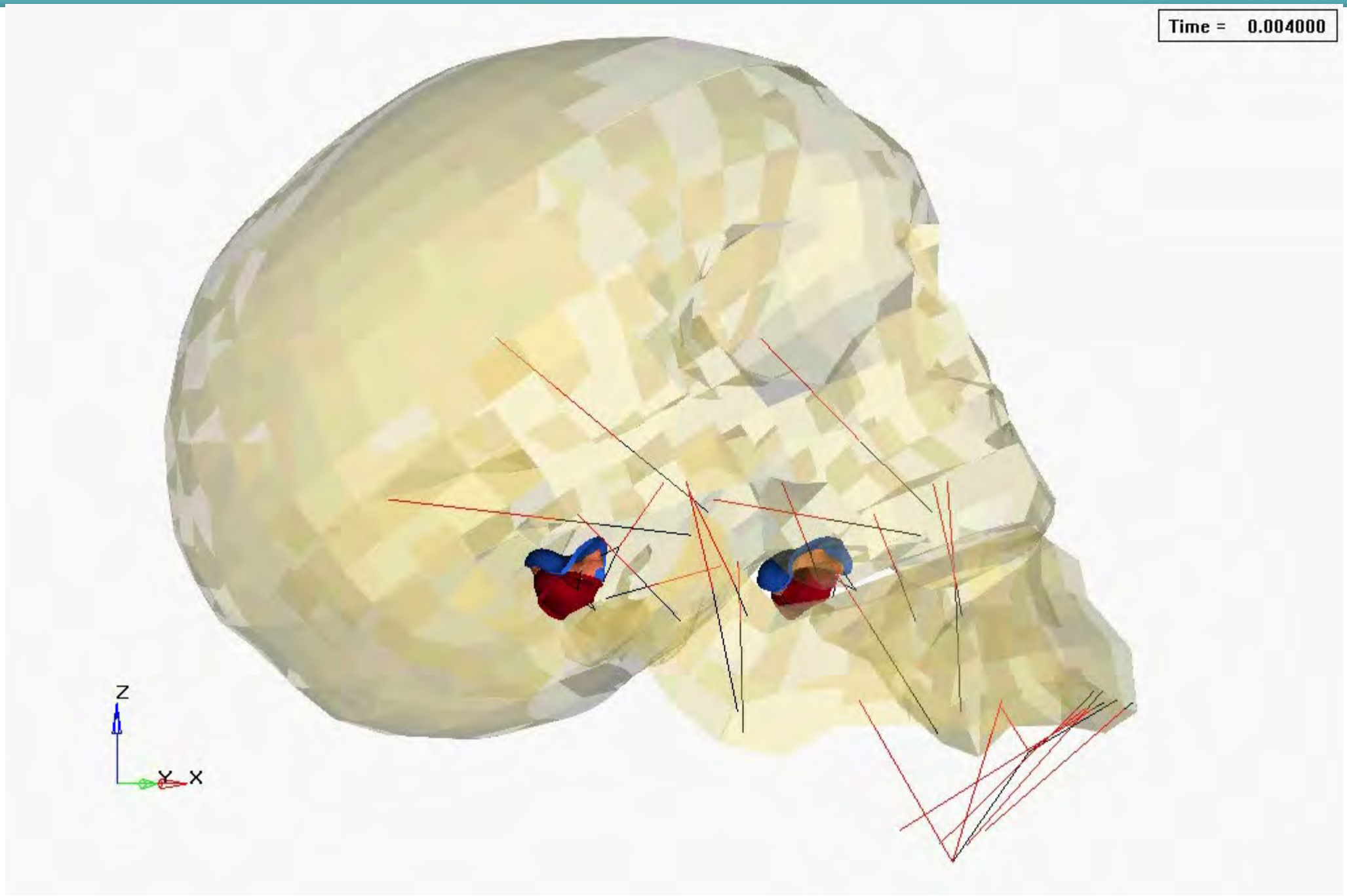
right-anterior view

aantal elementen:

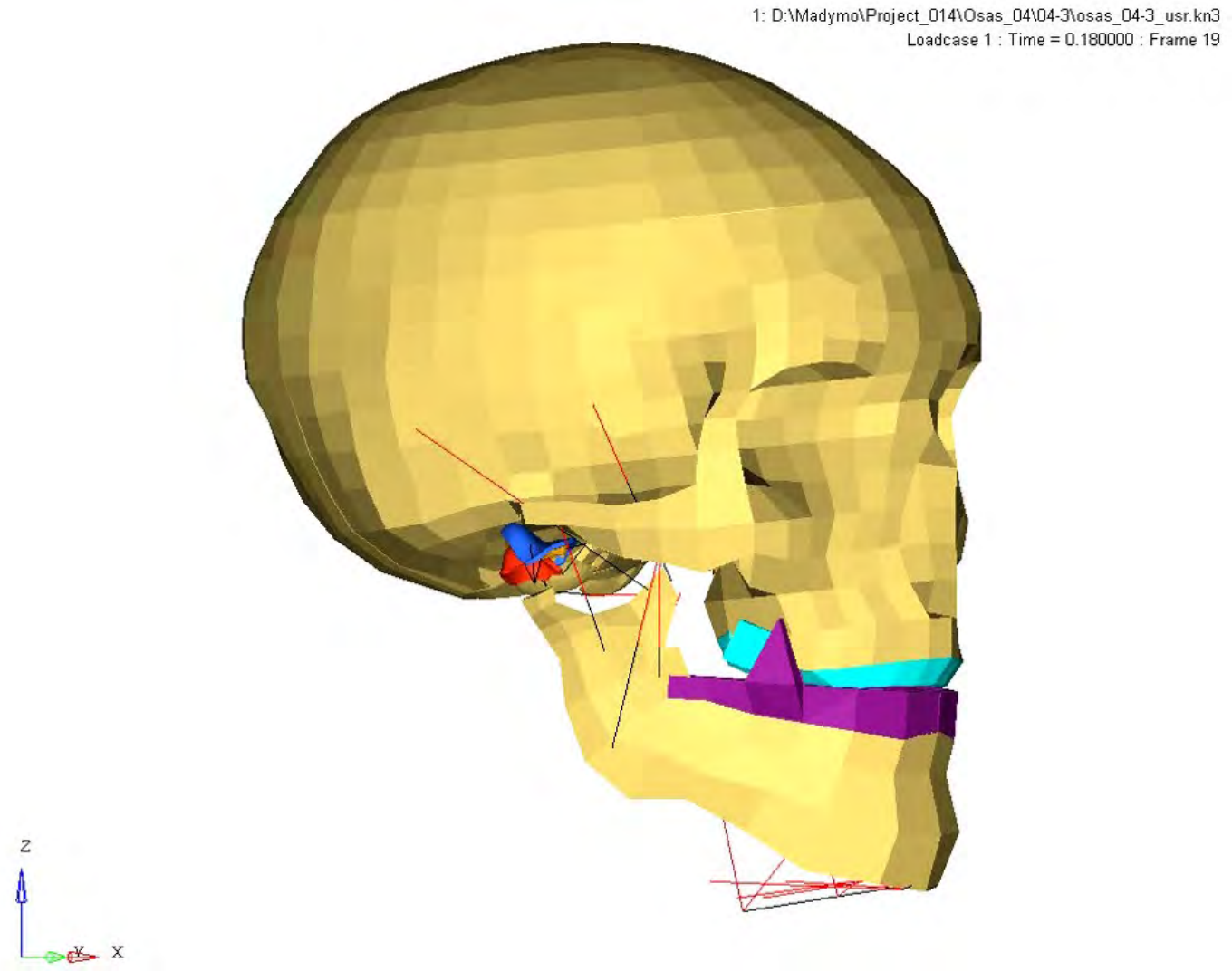
temporaal kraakbeen - 14500
discus - 12500
condylair kraakbeen - 12200

Heidsieck DSP, Koolstra JH, **de Ruiter MHT**, Hoekema A, de Lange J. Biomechanical effects of a mandibular advancement device on the temporomandibular joint. Journal of Cranio-Maxillofacial Surgery 2018; 46(2): 288-292.

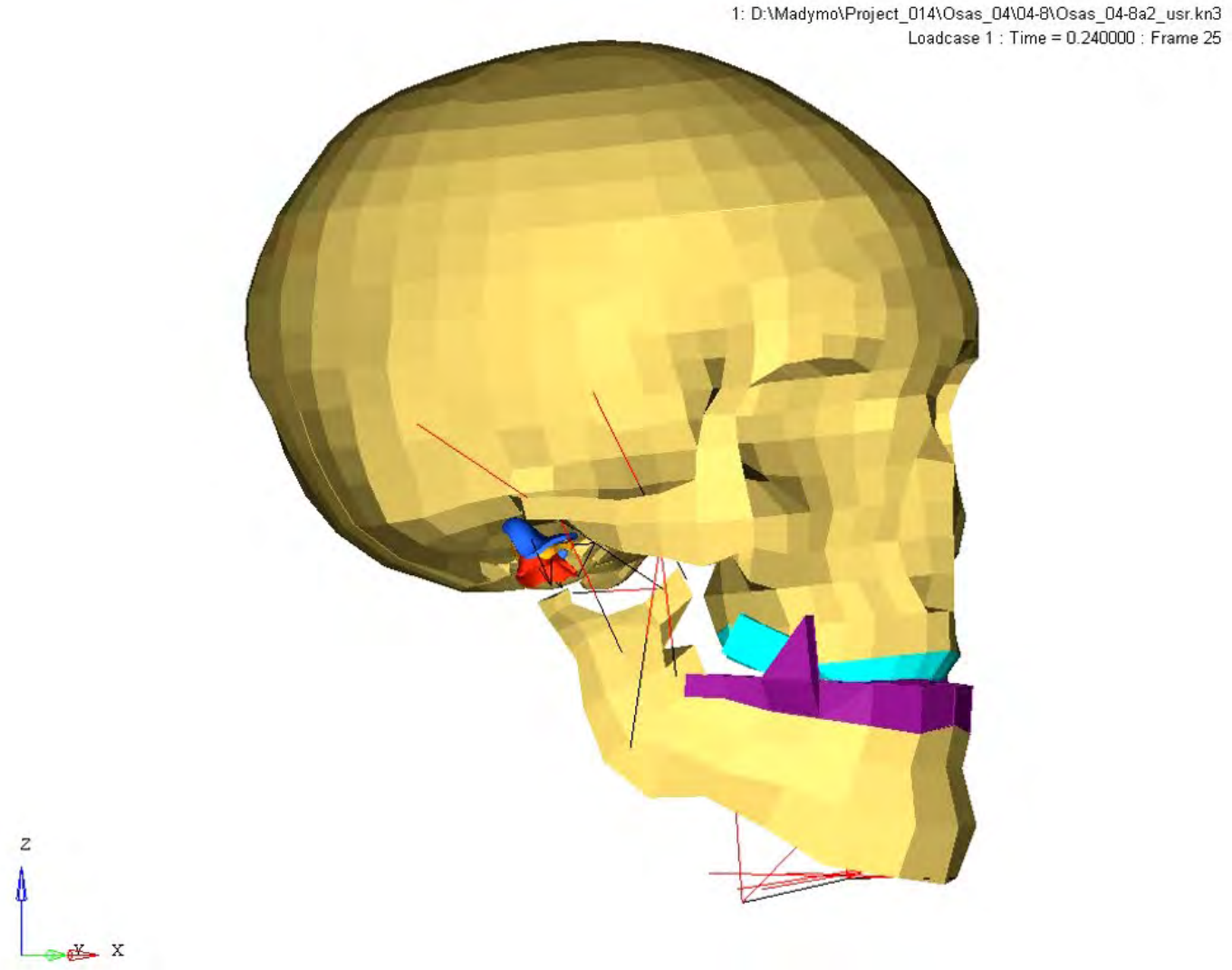

jaw model
TEM_P
TEM_A
LPT_S
LPT_I
MAS_P
MPT
MAS_S
MYH
GEH
DIG
muscle model
origin
F sarcomeres
F active
F passive
activation dynamics
1
0
0.4
0.8
time (s)
force-length factor
1
2
3
4
sarcomere length (µm)
force-velocity factor
1
-10
0
10
contraction velocity (µm/s)
parallel elastic force factor
0.02
0.01
2
3
4
sarcomere length (µm)
insertion


Time = 0.004000
Z
Y
X

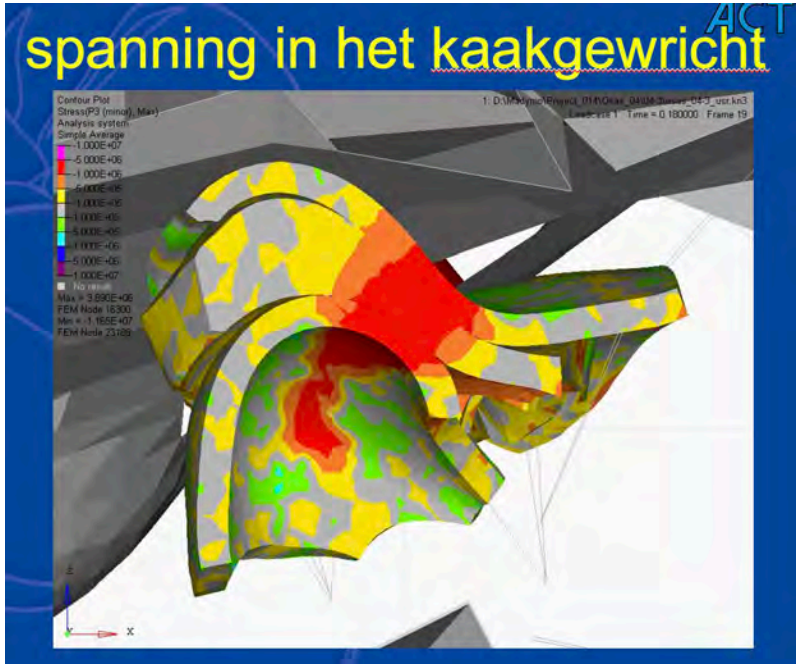
Open and close

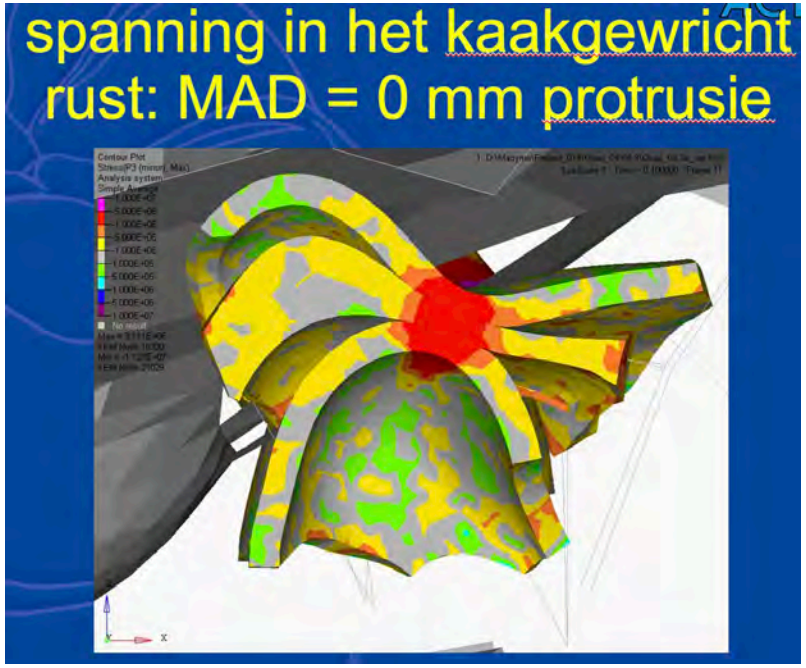


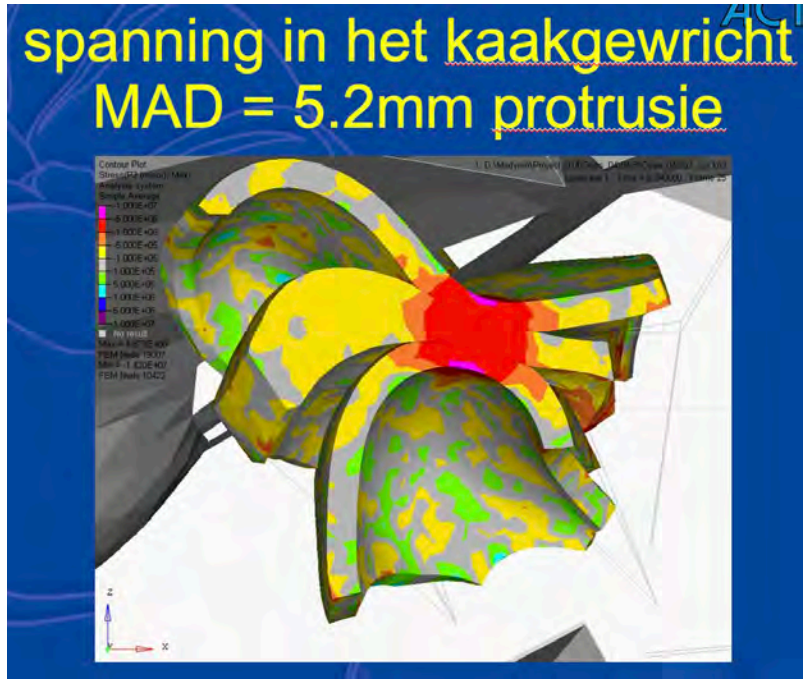
5.2 mm protrusion



Tension in Joint







Conclusion

Usage of a MAD could result in (temporarily) remodelling of the JOINT, but no substantial extra forces are expected

Diakonessenhuis

Sleep Breath (2016) 20:395–404
DOI 10.1007/s11325-015-1285-9

DENTISTRY • REVIEW

Management of obstructive sleep apnea in edentulous patients: an overview of the literature

David S. P. Heidsieck[1] · Maurits H. T. de Ruiter[1] · Jan de Lange[1]

Received: 4 May 2015 / Revised: 20 October 2015 / Accepted: 28 October 2015 / Published online: 19 November 2015

Edentuluous patient

- Dental status of 34% of the patient is unfit for MAD
- Treatment options are limited; CPAP or surgery

Implantaat gedragen MRA

Randomised controlled trial

- Continuous Positive Airway Pressure
- Implantaat gedragen MRA

POSA trial: MRA versus SPT

Conclusion POSA trial
MRD vs SPT

High efficacy (AHI van 12.9 naar 5.0)
High compliance (>4 uur 5D/week 80-90%)

de Ruiter et al. Durability of treatment effects of the Sleep Position Trainer versus oral appliance therapy in positional OSA: 12-month follow-up of a randomized controlled trial. Sleep and Breathing (2018): 441-450.

Maxillomandibular Advancement

MMA

Pick your winners

NO

Comorbidity
“older” patients
Neck circumference >43 cm
Previous multilevel surgery (ENT)

YES

“Young” patients (<55 years)
Maxilla and mandibular hypoplasia (orthognathic)
No BMI restriction
No AHI restriction

- Patient characteristics

Success on AHI MMA = CPAP 2008

Available online at www.sciencedirect.com
ScienceDirect
American Journal of Otolaryngology–Head and Neck Medicine and Surgery 31 (2010) 14–20
American Journal of OTOLARYNGOLOGY
www.elsevier.com/locate/amjoto

Surgery vs ventilation in adult severe obstructive sleep apnea syndrome☆

Claudio Vicini, MD[a], Iacopo Dallan, MD[b,*], Aldo Campanini, MD[a], Andrea De Vito, MD[a], Francesca Barbanti, MD[a], Gianluca Giorgiomarrano, MD[a], Marcello Bosi, MD[c], Giuseppe Plazzi, MD[d], Federica Provini, MD[d], Elio Lugaresi, MD[d]

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[b]*Second ENT Unit, Azienda Ospedaliero-Universitaria Pisana, Pisa, Italy*
[c]*Sleep Centre, Pneumologic Unit, Ospedale Morgagni Pietrantoni, Forlì, Italy*
[d]*Sleep Centre, Neurological Clinic, University of Bologna, Bologna, Italy*

Received 12 May 2008

Success on AHI MMA > MLS 2020

Sleep Medicine Reviews 57 (2021) 101471

Contents lists available at ScienceDirect

Sleep Medicine Reviews

journal homepage: www.elsevier.com/locate/smrv

CLINICAL REVIEW

Maxillomandibular advancement versus multilevel surgery for treatment of obstructive sleep apnea: A systematic review and meta-analysis☆

Ning Zhou [a, b, *], Jean-Pierre T.F. Ho [a], Zhengfei Huang [b, c], René Spijker [d, e], Nico de Vries [b, f, g], Ghizlane Aarab [b], Frank Lobbezoo [b], Madeline J.L. Ravesloot [f], Jan de Lange [a]

Success on AHI **MMA = Inspire** **2021**

Journal of *Clinical Medicine*

MDPI

Systematic Review

Maxillomandibular Advancement and Upper Airway Stimulation for Treatment of Obstructive Sleep Apnea: A Systematic Review

Ning Zhou [1,2,3,*,†], Jean-Pierre T. F. Ho [1,2,4,†], René Spijker [5,6], Ghizlane Aarab [3], Nico de Vries [3,7,8], Madeline J. L. Ravesloot [7] and Jan de Lange [1,2]

Resultaten

Surgical success:
- AHI drop below <20 *and* >50%

Surgical cure
- AHI drop <5

	Literature MMA[1]	Our MMA cohort[2]
Success	86%	71%
Cure	43%	24%

1. Zaghi S, Holty JE, Certal V, et al. Maxillomandibular Advancement for Treatment of Obstructive Sleep Apnea: A Meta-analysis. JAMA Otolaryngol Head Neck Surg 2016;142:58-66.

2. de Ruiter MHT, Apperloo RC, Milstein DMJ, de Lange J. Assessment of obstructive sleep apnoea treatment success or failure after maxillomandibular advancement. Int J Oral Maxillofac Surg 2017 46(11), 1357-1362.

Kenmerken kaakoperatie op het Diak

- 3D planning operatie
- Soms orthodontische behandeling erbij (een slotjes beugel)
- Operatie duurt ongeveer 100-120 min
- Twee MKA-chirurgen voeren dit samen uit
- Soms een nachtje na operatie op de Intensive Care
- Naar huis na soms 1 nacht, meestal 2 nachten.
- Controles na een week, twee weken, 6 weken, 3 maanden, 1 jaar en 2 jaar

Complicaties van de kaakoperatie

- 80-90% effectief (net zo goed als CPAP)
- 10-40% kans op schade aan de zenuw in de onderkaak (gevoel)
- 40% kans op matig stand kiezen op elkaar (daarom de ortho)
- Ander gezicht, esthetisch
- Goede, intensieve patientenbegeleiding

Esthetiek van het gezicht

	Study patients (n = 37)	MMA success (n=24)	MMA Failure (n=13)
	Mean (±SD)	**Mean (±SD)**	**Mean (±SD)**
VAS snoring pre-operative (0-10)	8.3 (±2.1)	8.4 (±1.8)	8.0 (±2.6)
VAS snoring post-operative (0-10)	2.0 (±2.1)	1.9 (±1.9)	2.0 (±2.4)
VAS aesthetics pre-operative (0-10)	5.8 (±2.2)	6.2 (±1.9)	5.1 (±2.7)
VAS aesthetics post-operative (0-10)	5.1 (±2.3)	5.7 (±2.1)	4.0 (±2.2)

Case 1

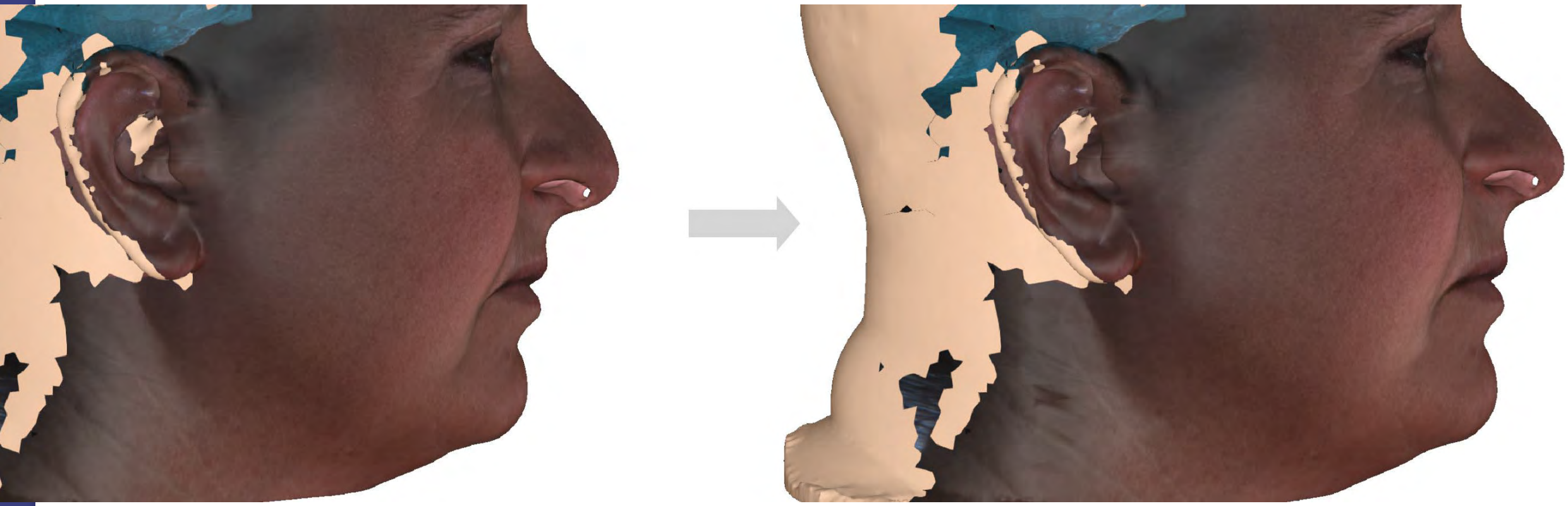
Mw N

53 jaar

OSA – AHI 20

CPAP intolerantie

MRA intolerantie

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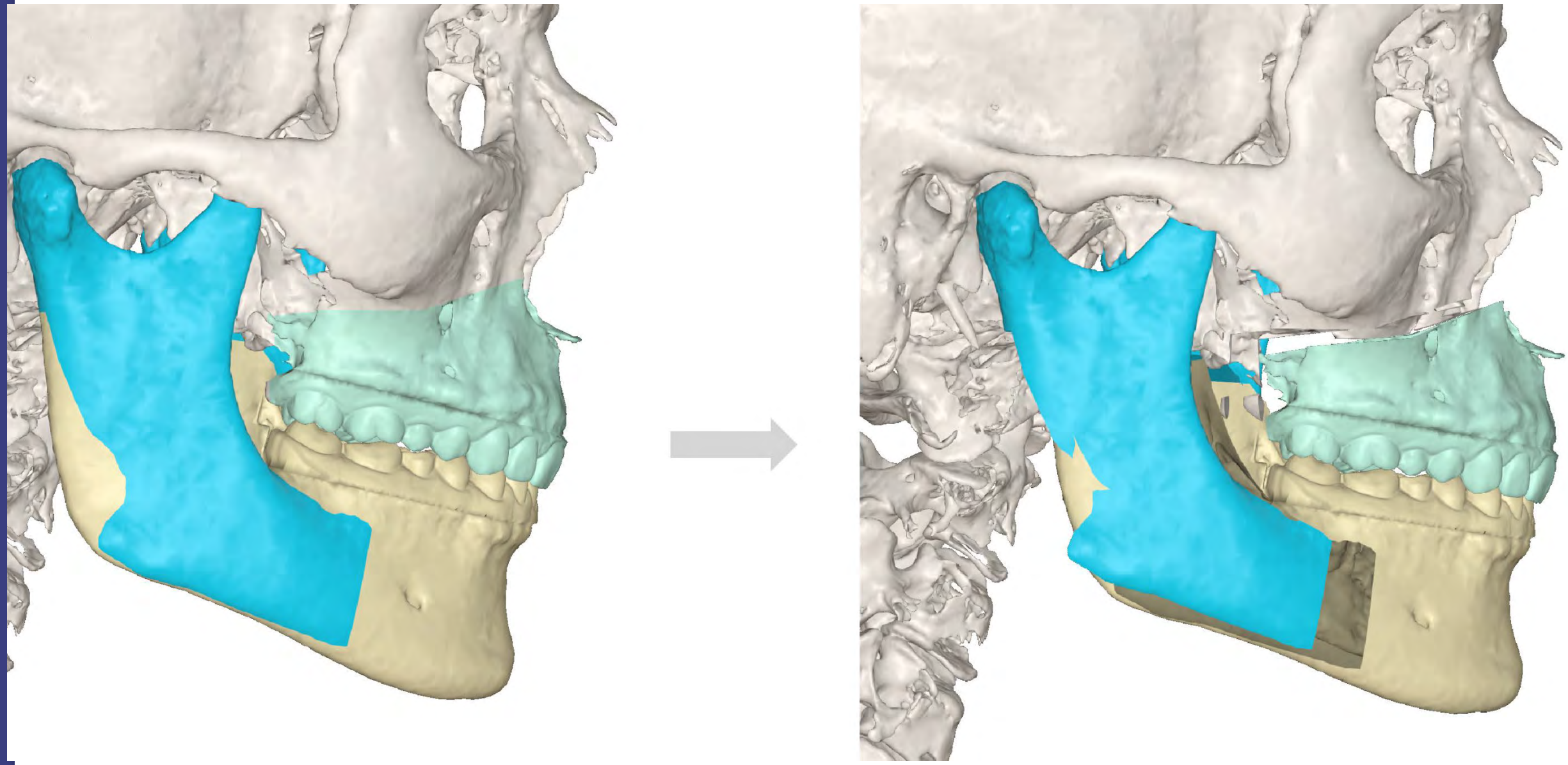
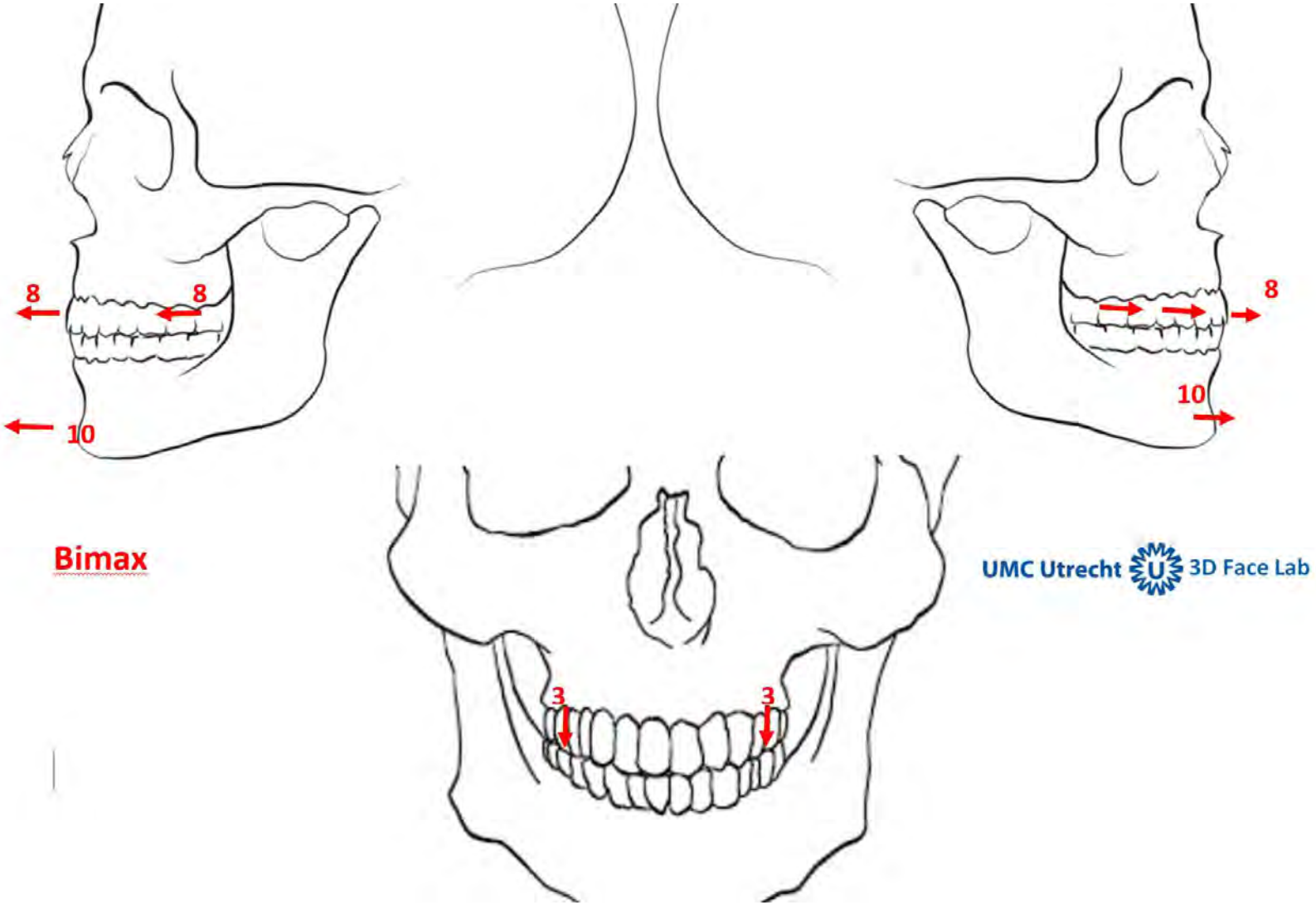
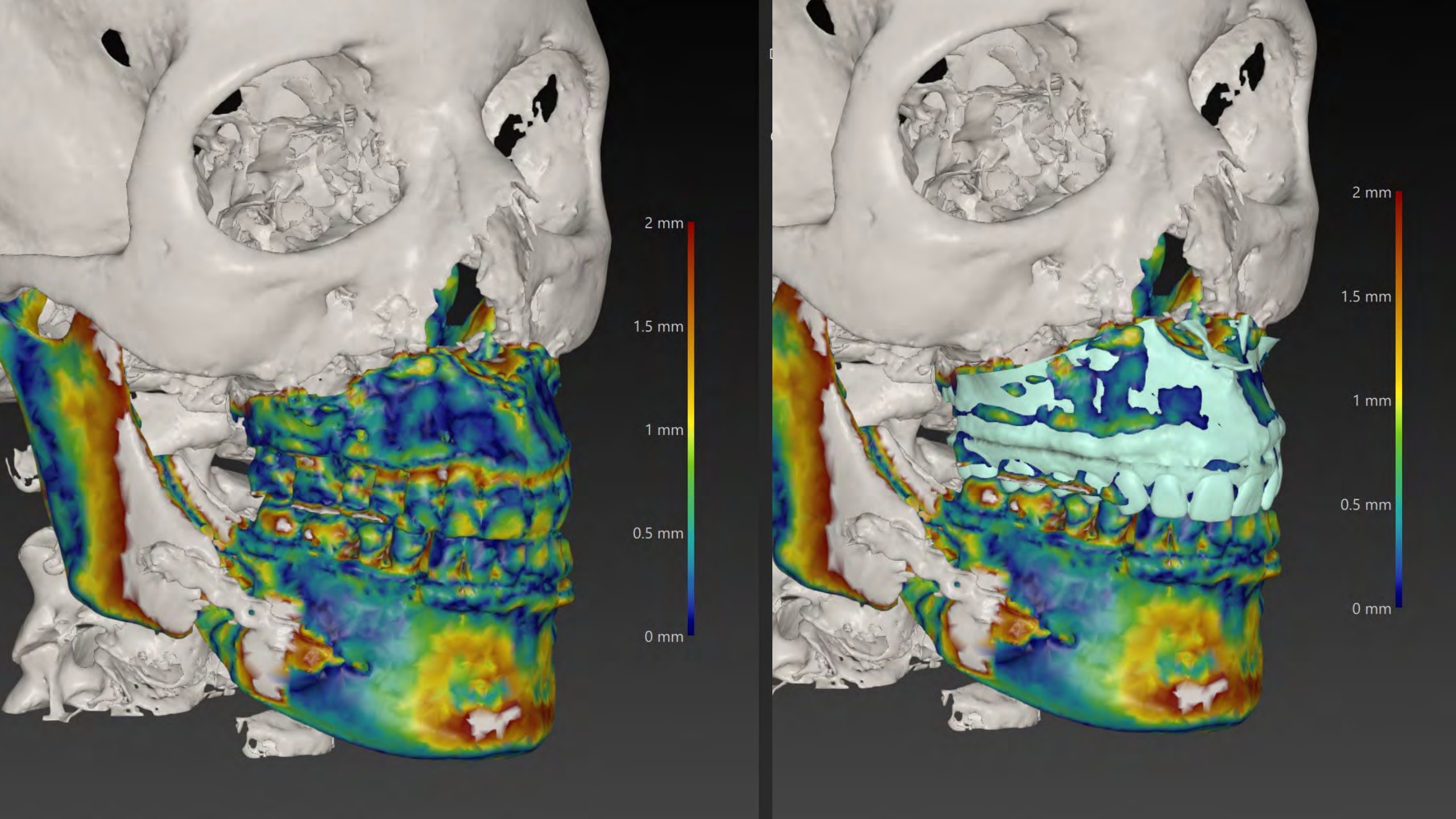




Bimax

UMC Utrecht 3D Face Lab


2 mm
1.5 mm
1 mm
0.5 mm
0 mm
2 mm
1.5 mm
1 mm
0.5 mm
0 mm

Mw N

53 jaar

OSA – AHI 20

CPAP intolerantie

MRA intolerantie

53 jaar
OSA – AHI 20 gedaald naar 7!

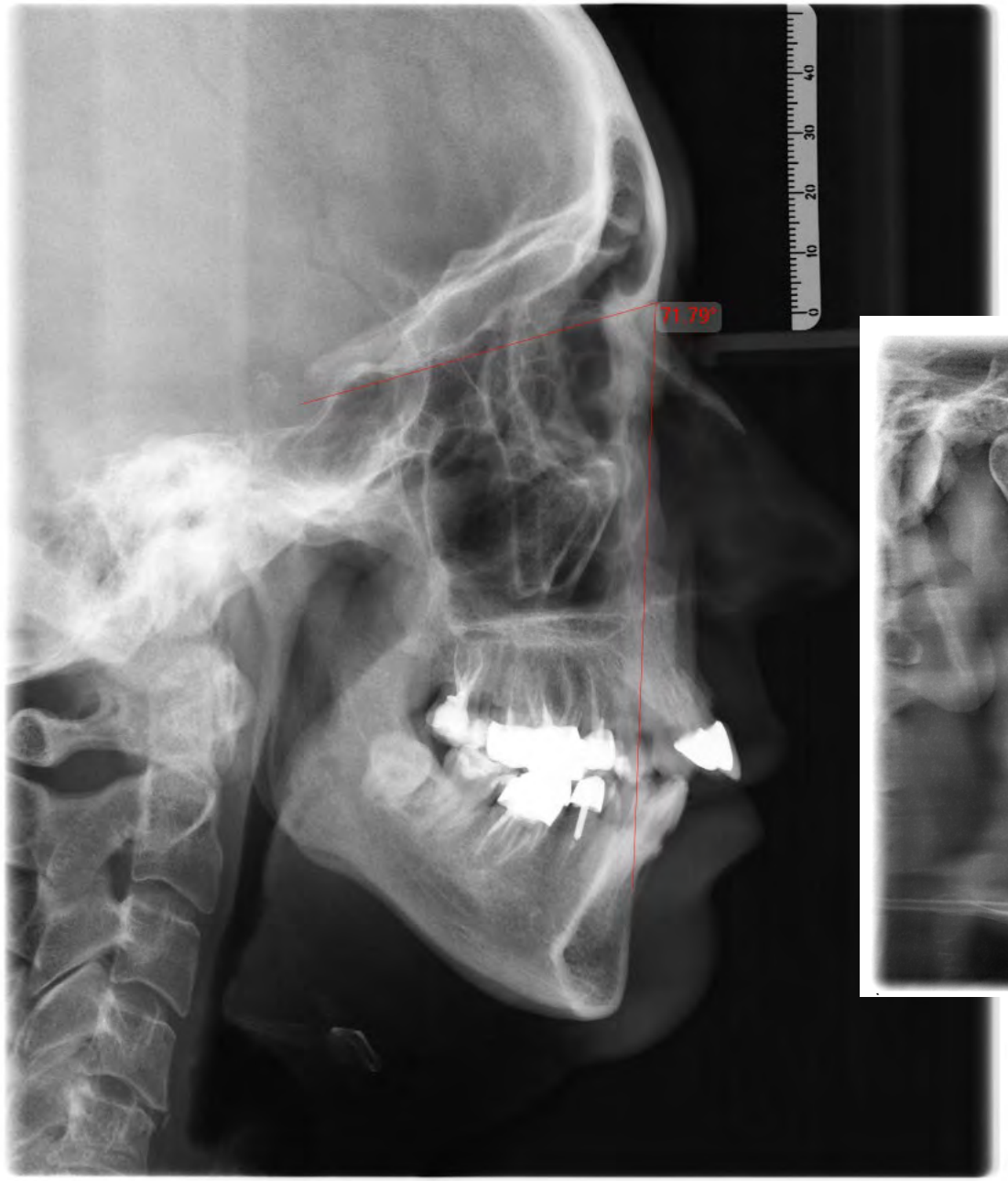
Sensibiliteit maxilla gestoord
Nog bezig met orthodontie

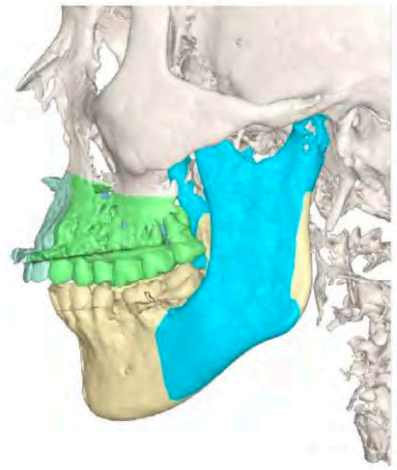
Case 2

Patient D

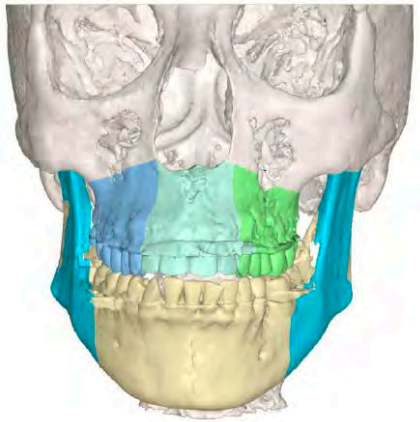
Female
48 yrs ; AHI 29,6

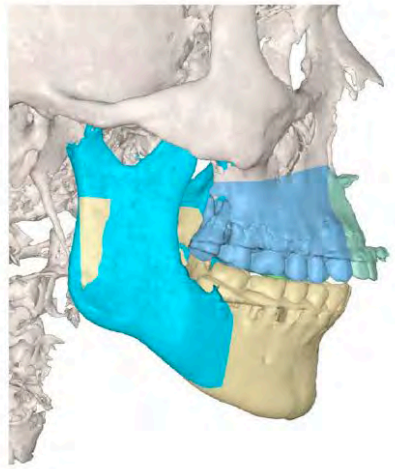
CPAP intolerance
MAD intolerance

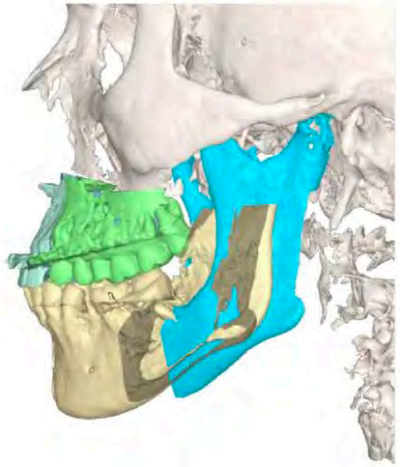

71.79°



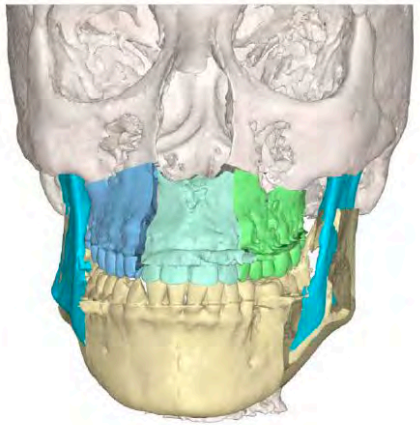
PRE-OP POSITION

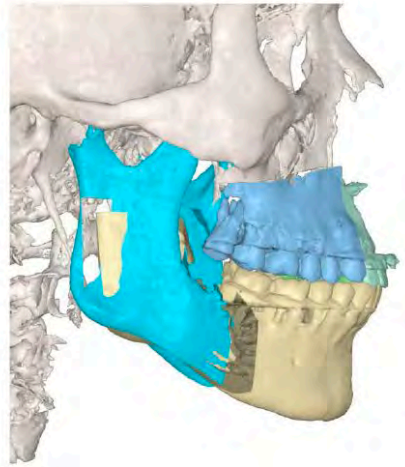




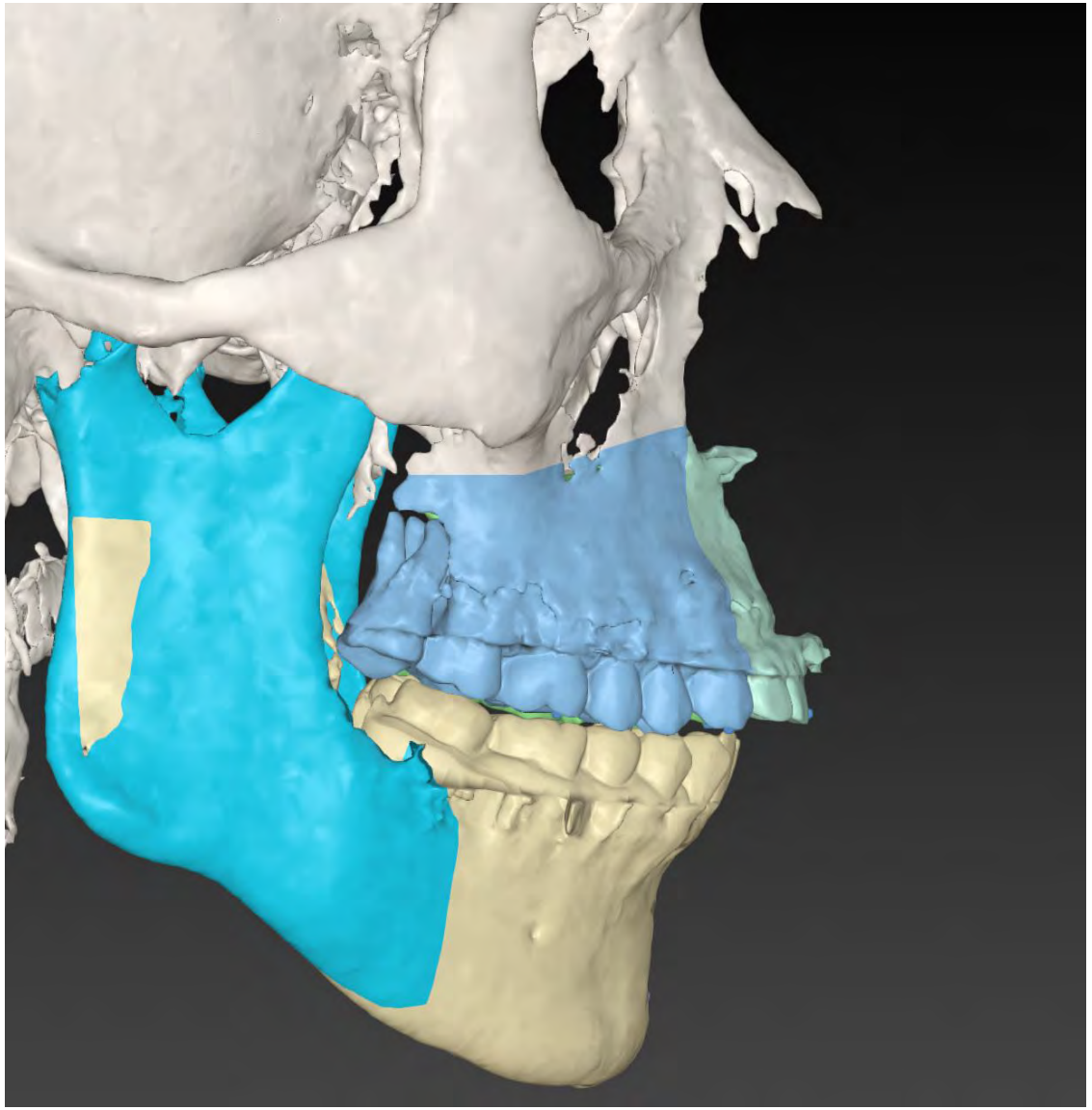


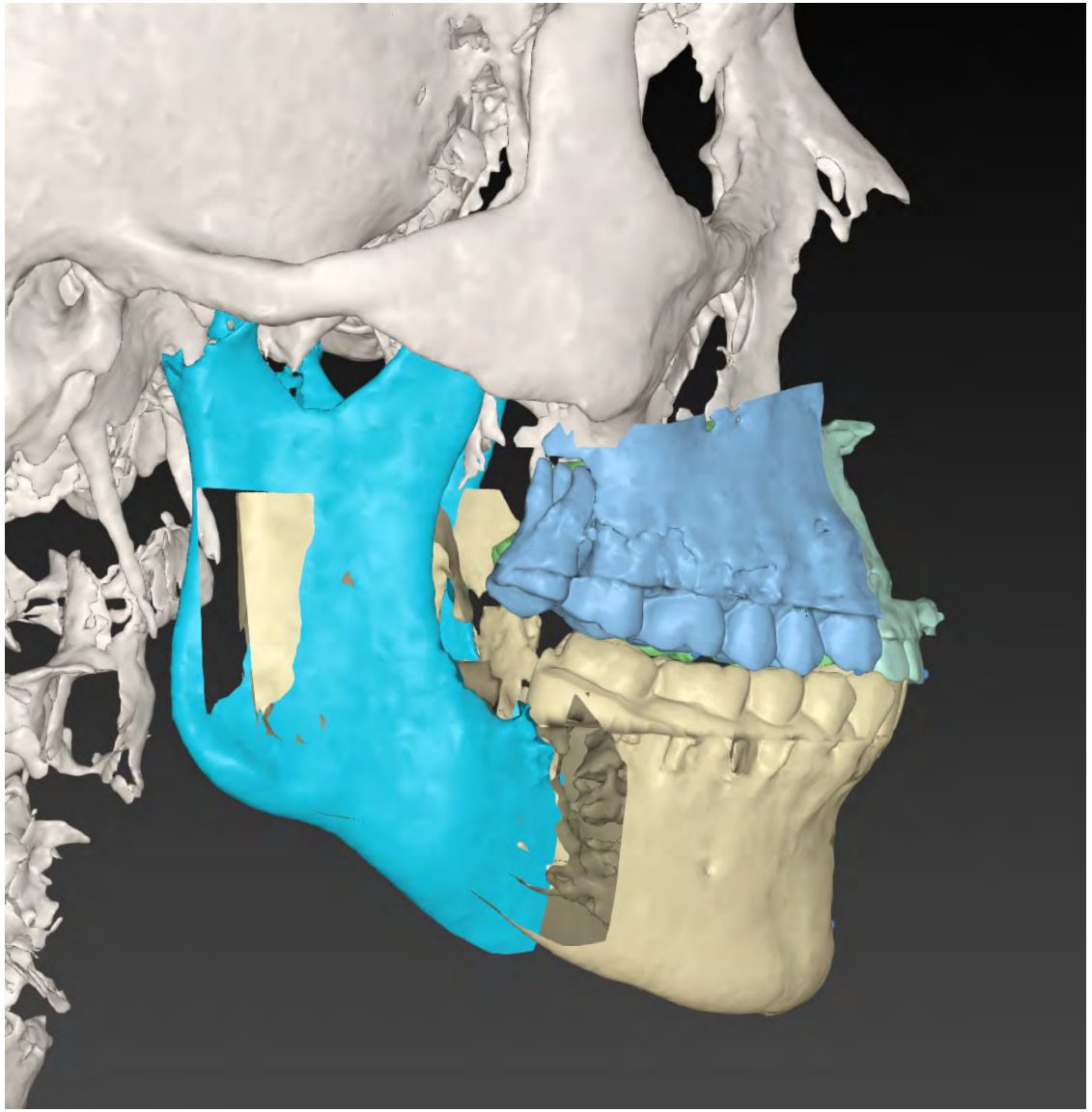
FINAL POSITION



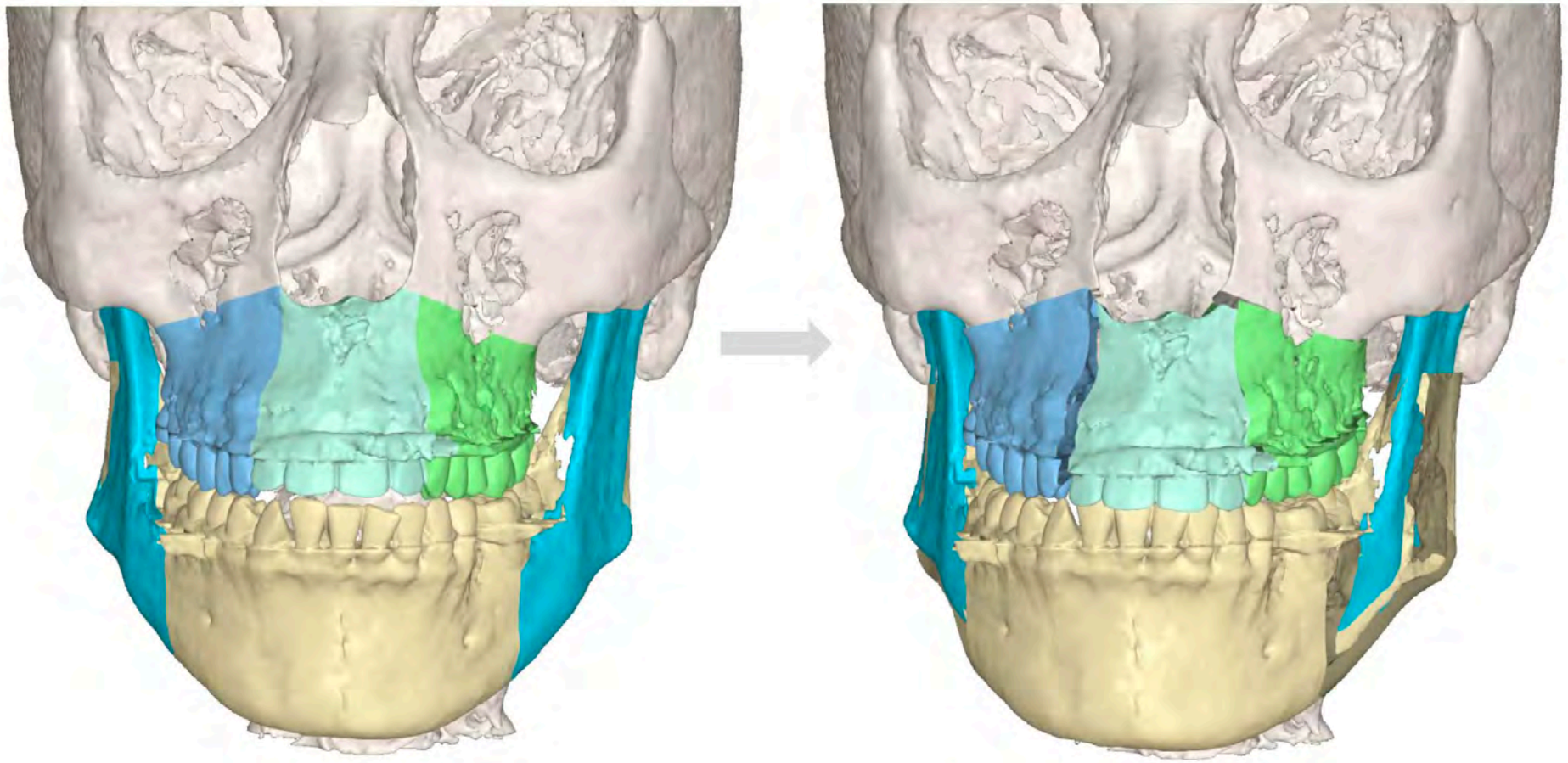


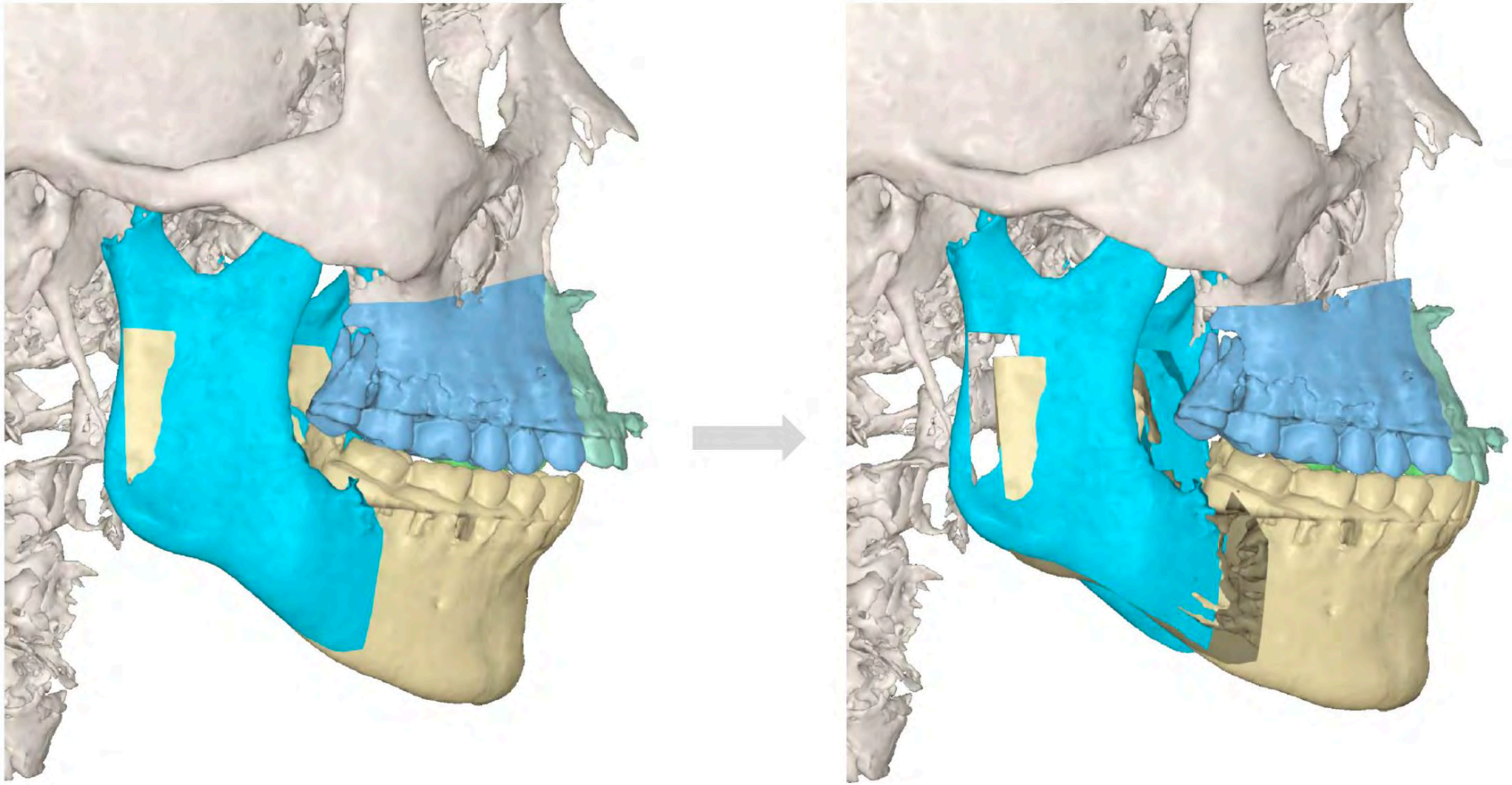
Planning: le Fort in 3 delen, 3mm advancement, front 2 mm caudaal, posterieur 0 mm
BSSO volgt

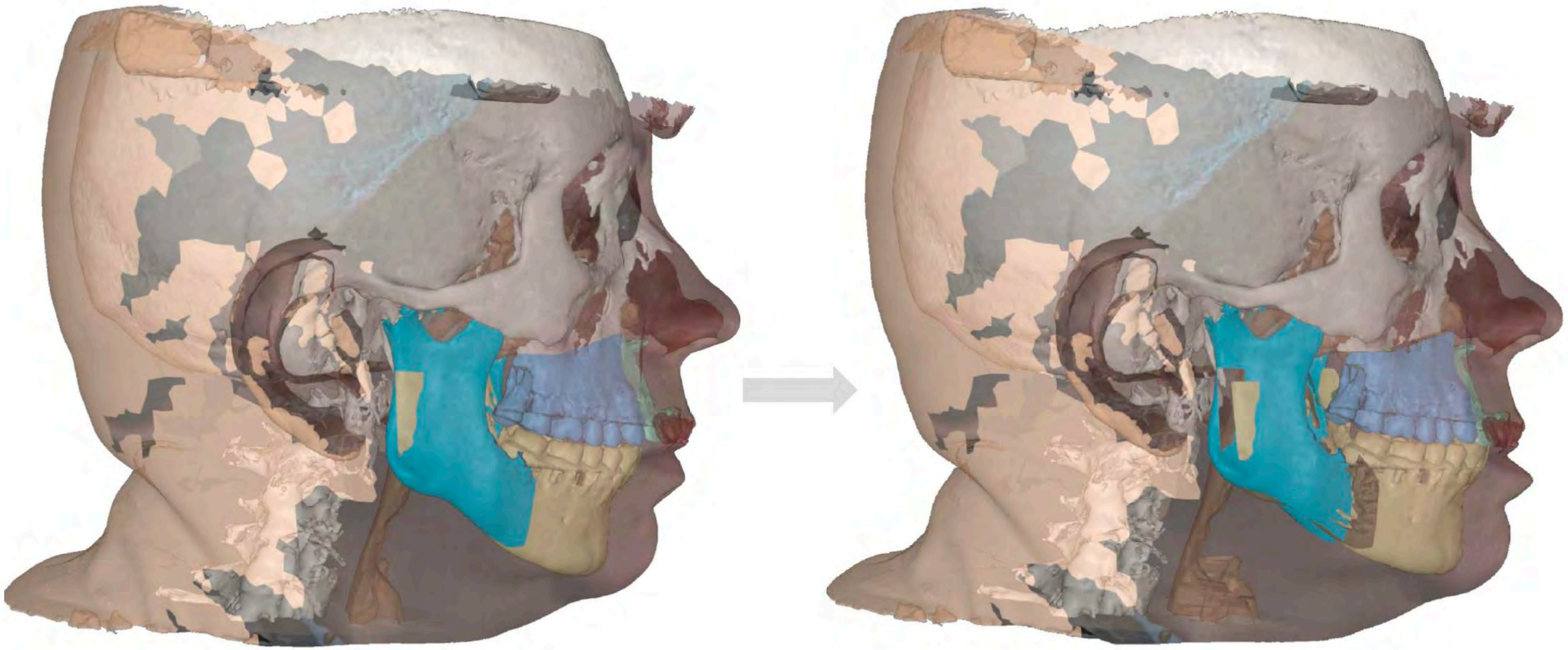


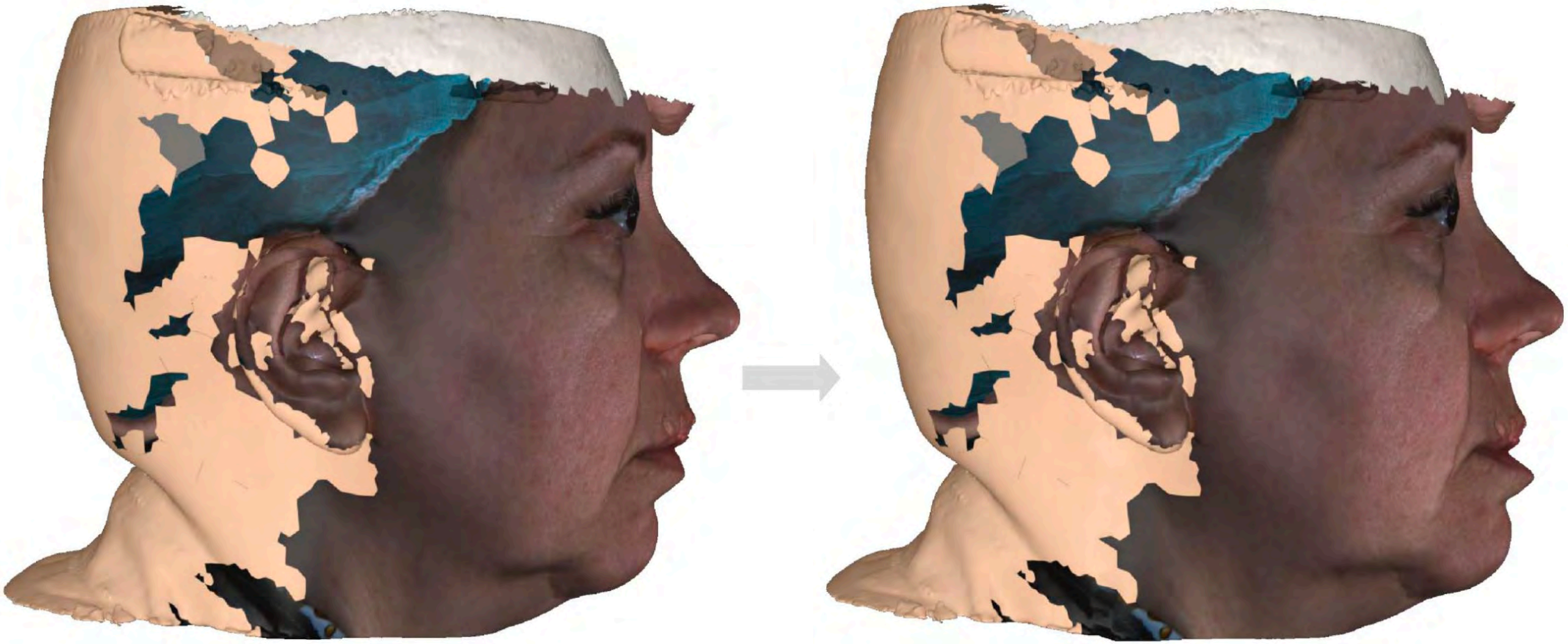


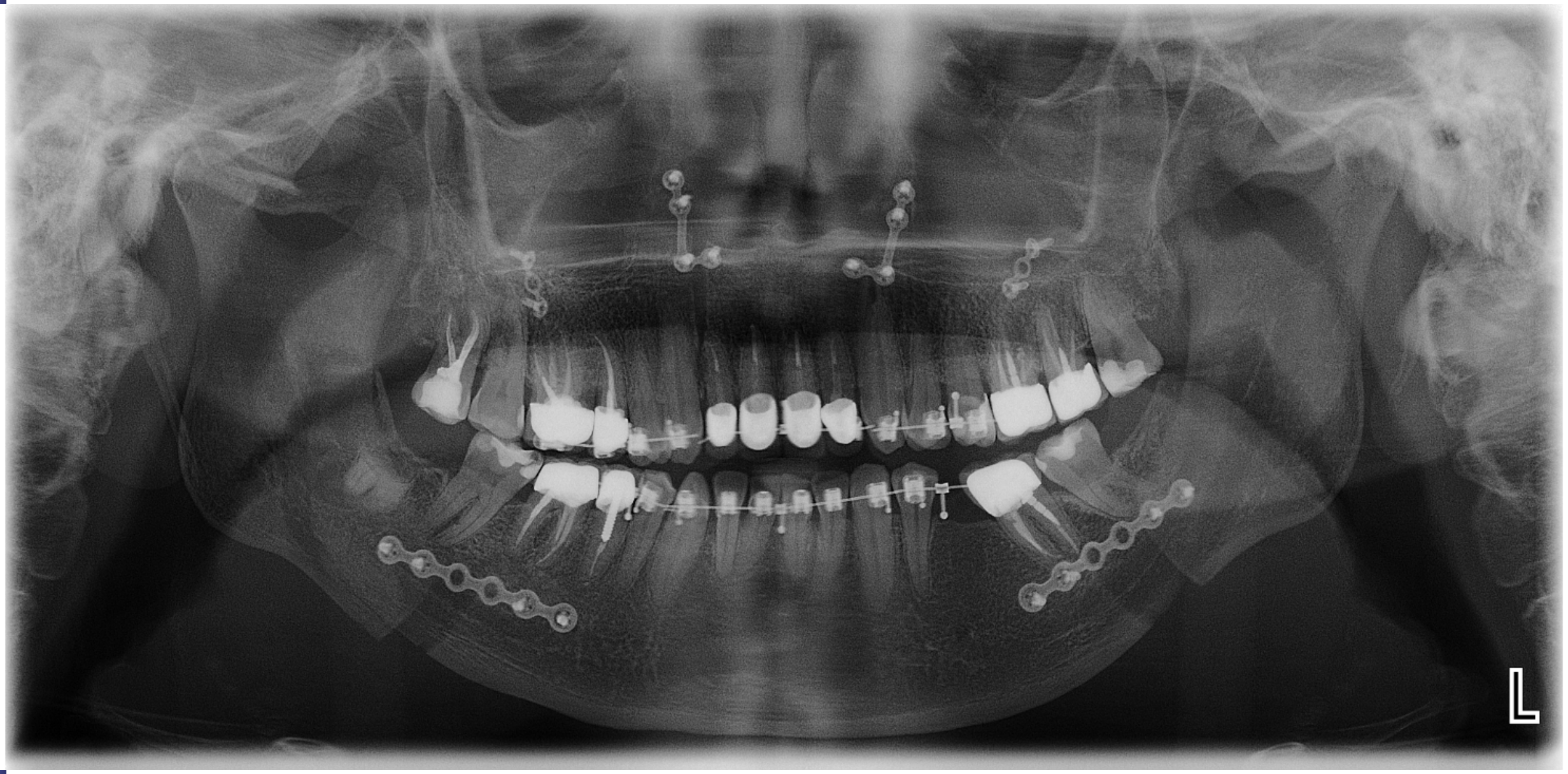
PLANNING SUMMARY

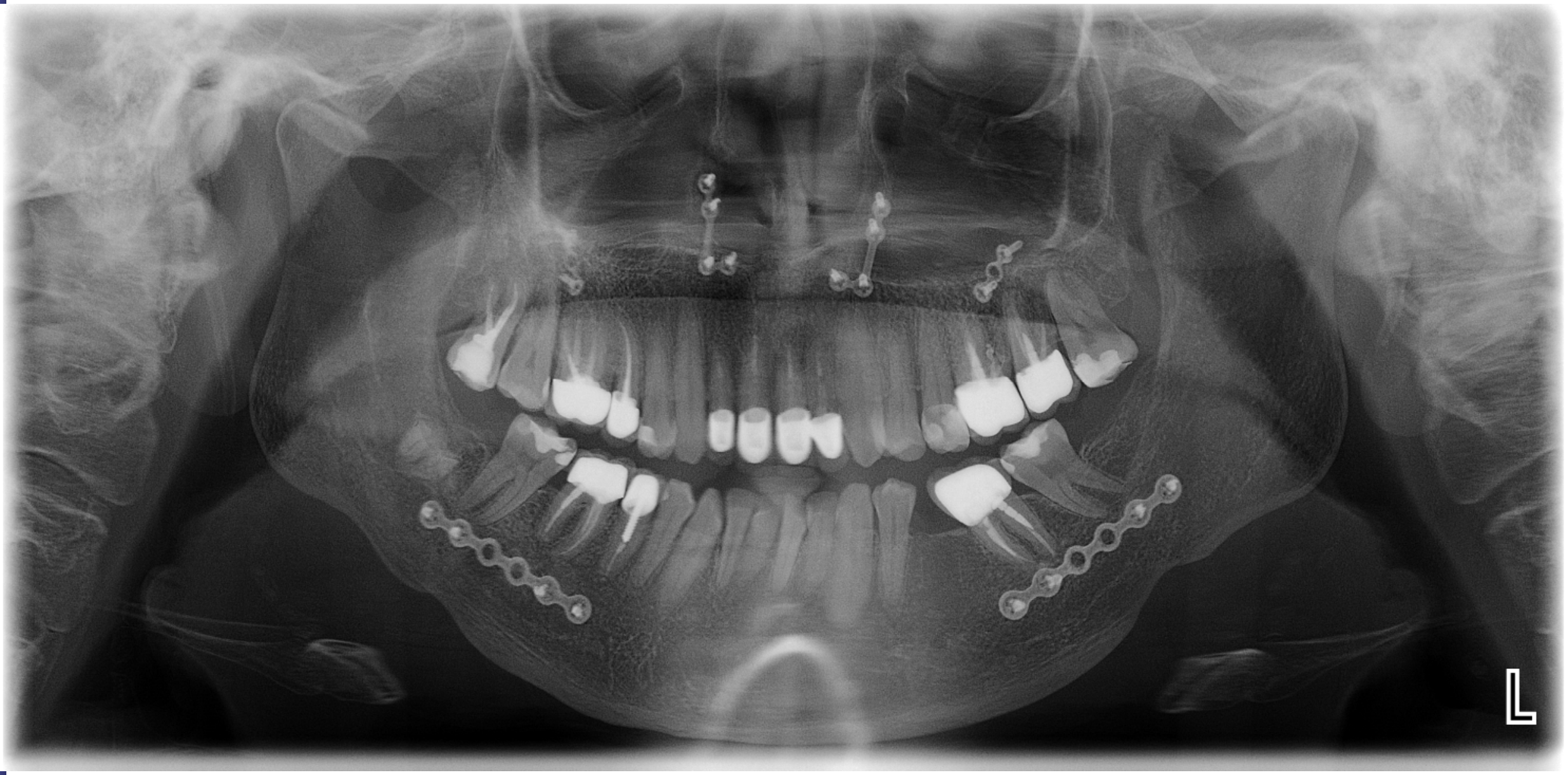








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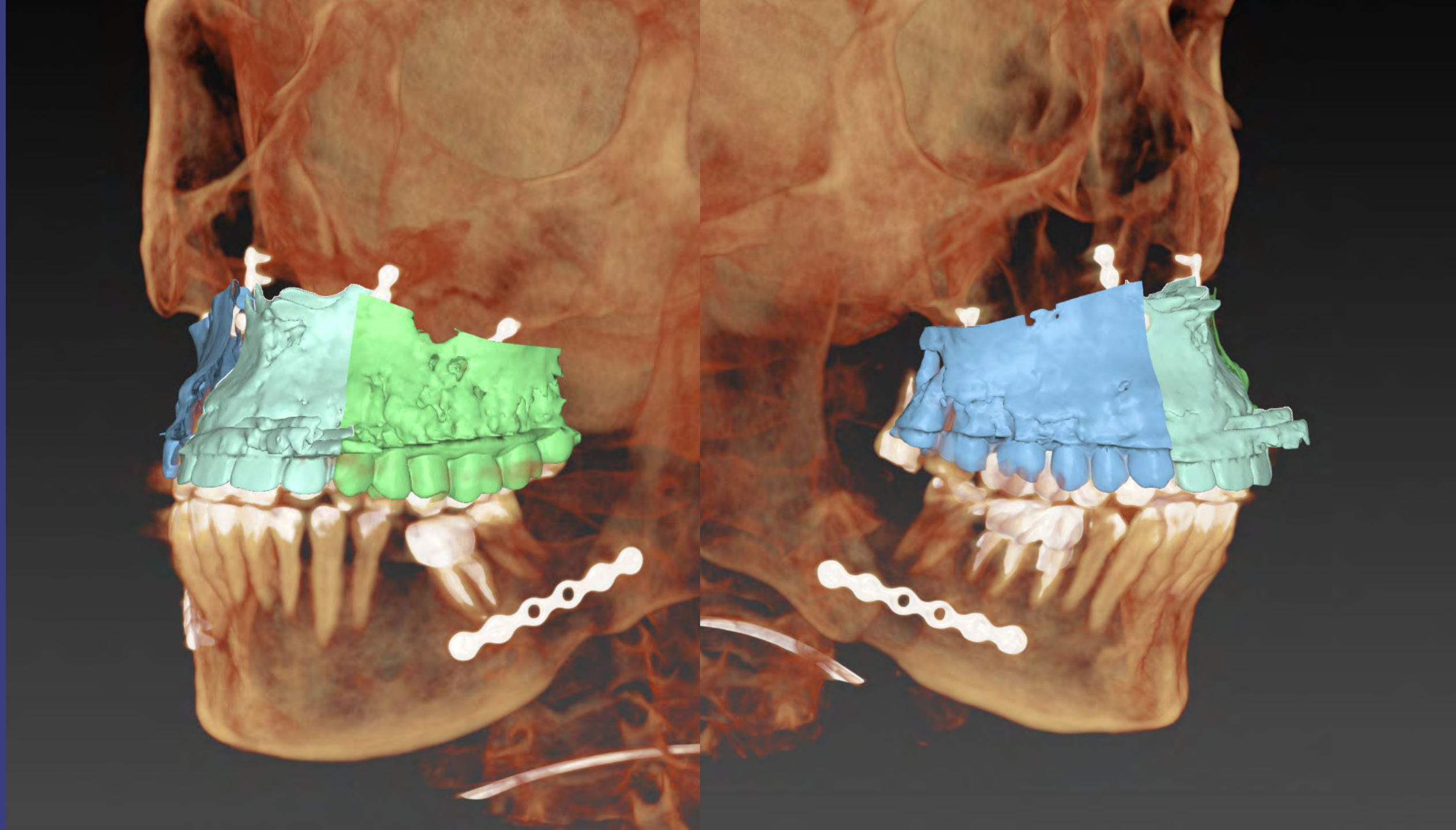
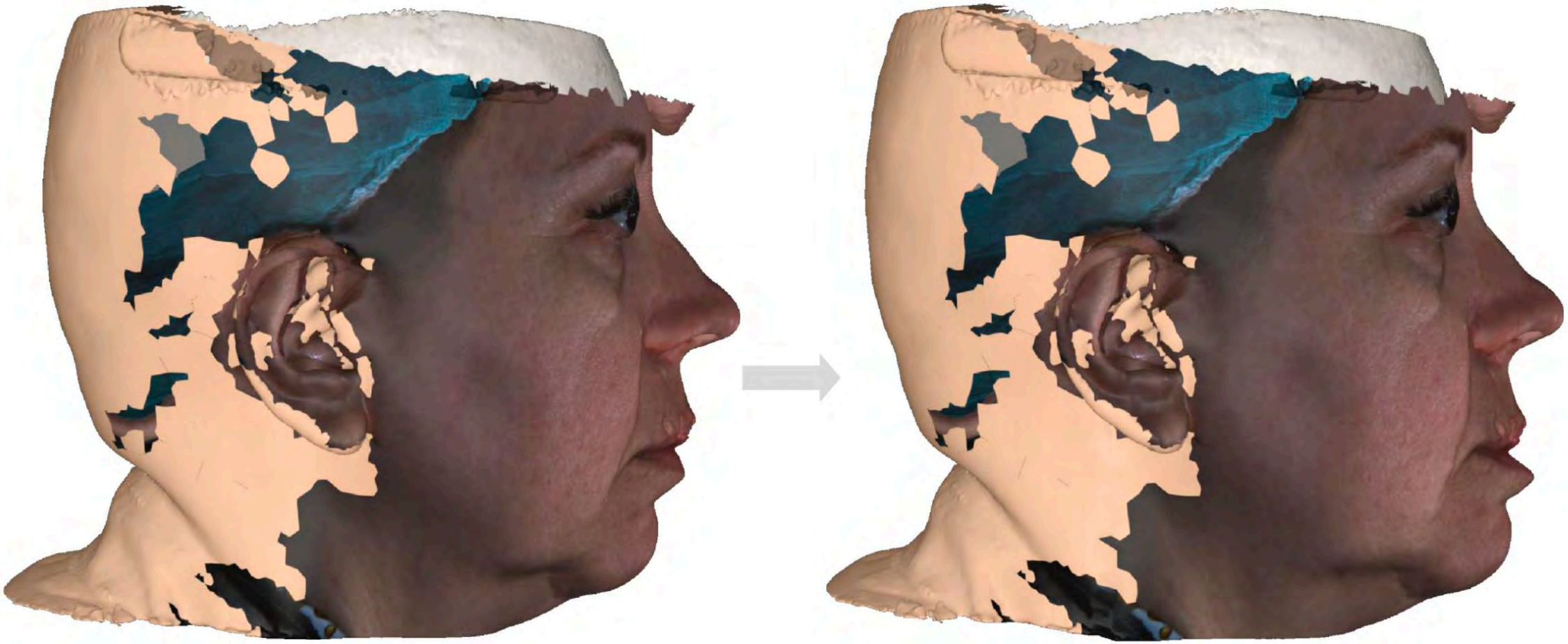


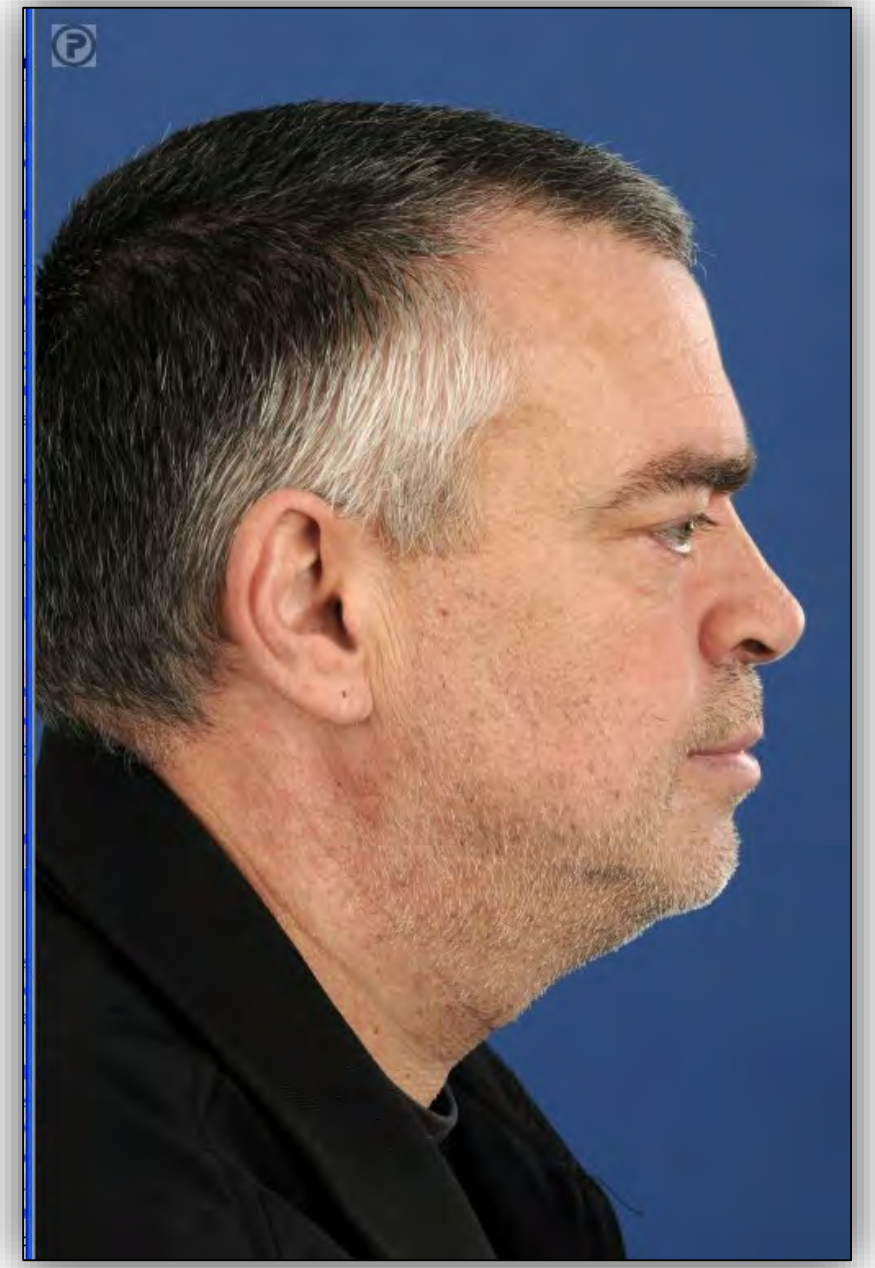


Patient D

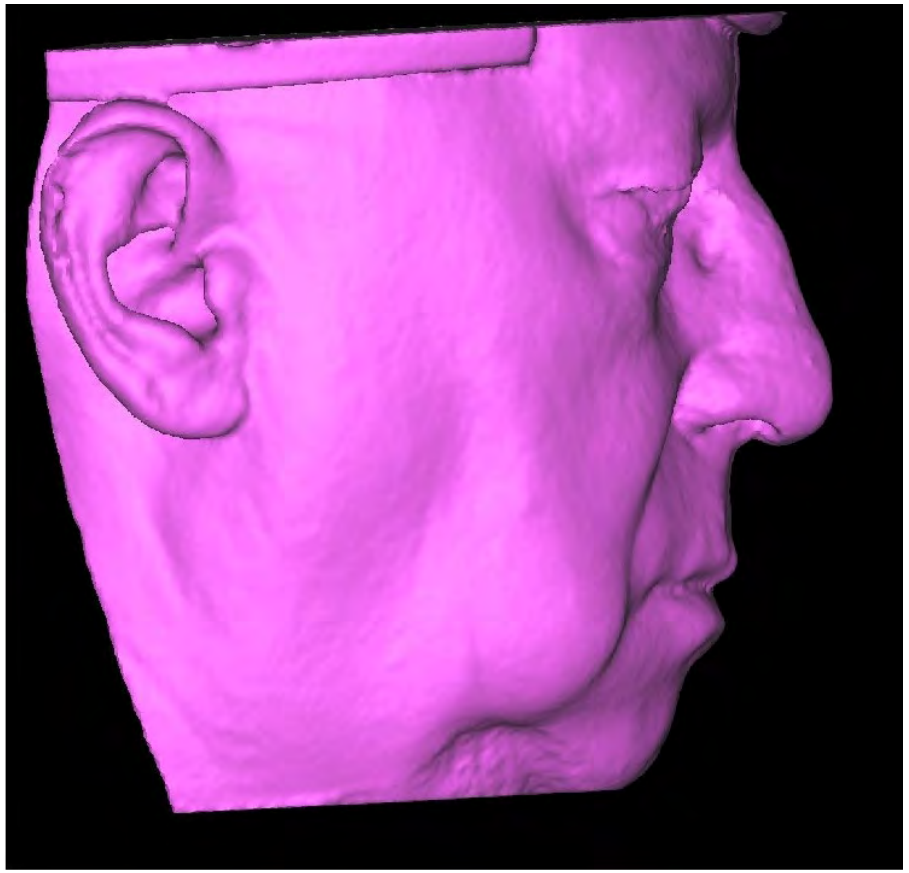
Female
48 yrs ; AHI 29,6
85 kg

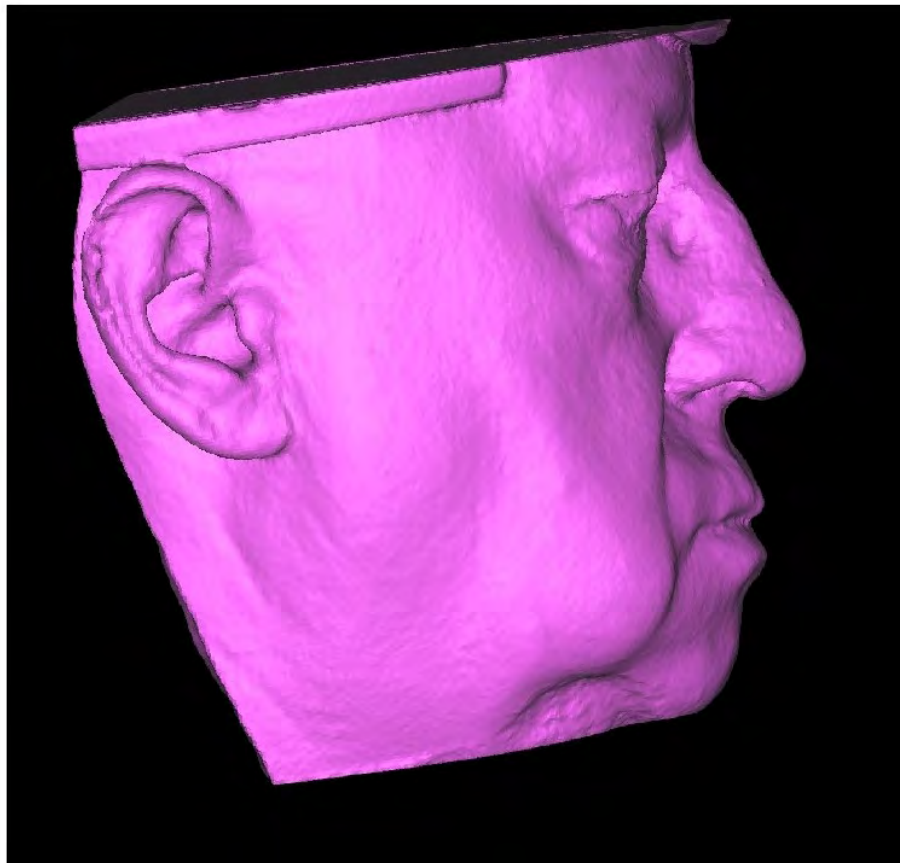
Nu AHI 4 (78 kg)
Subjectief veel verbetering

Case 3

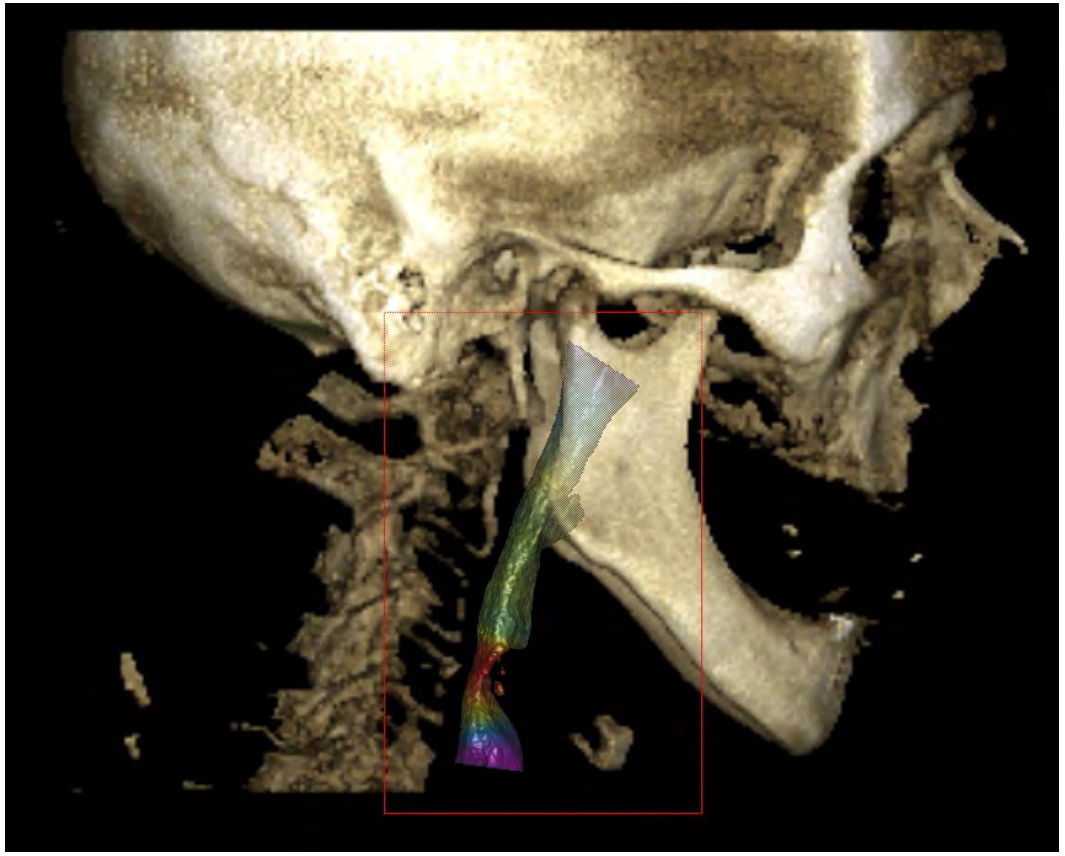


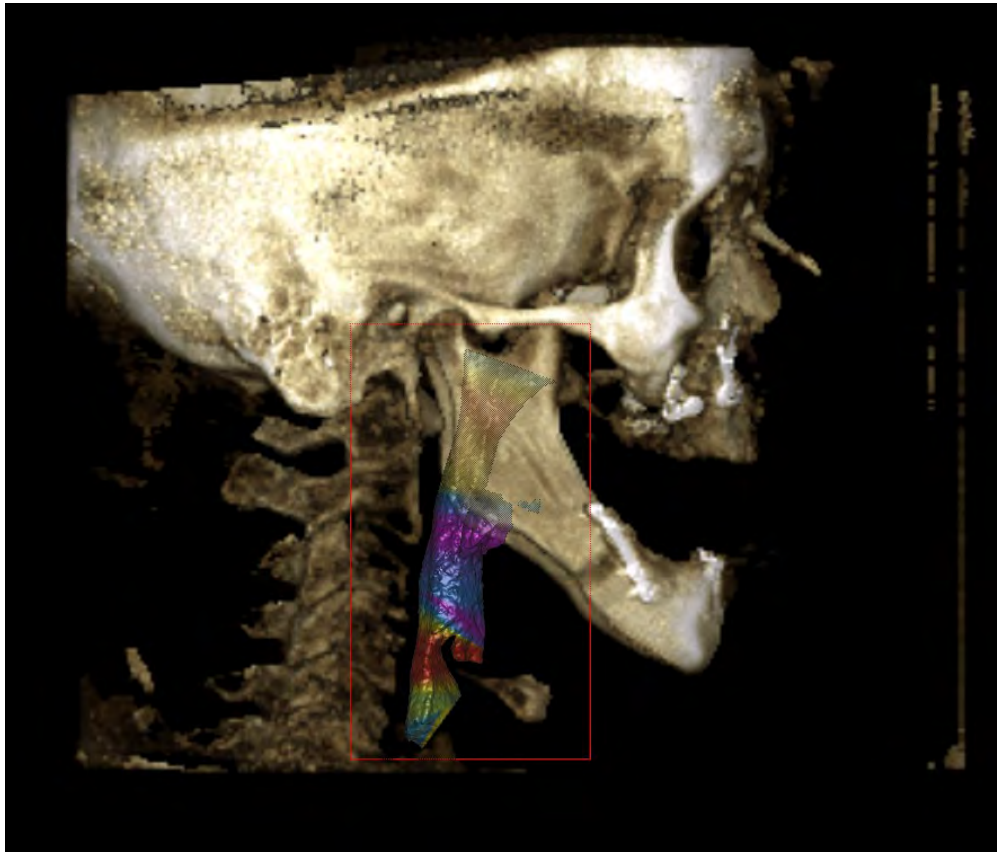
Diakonessenhuis

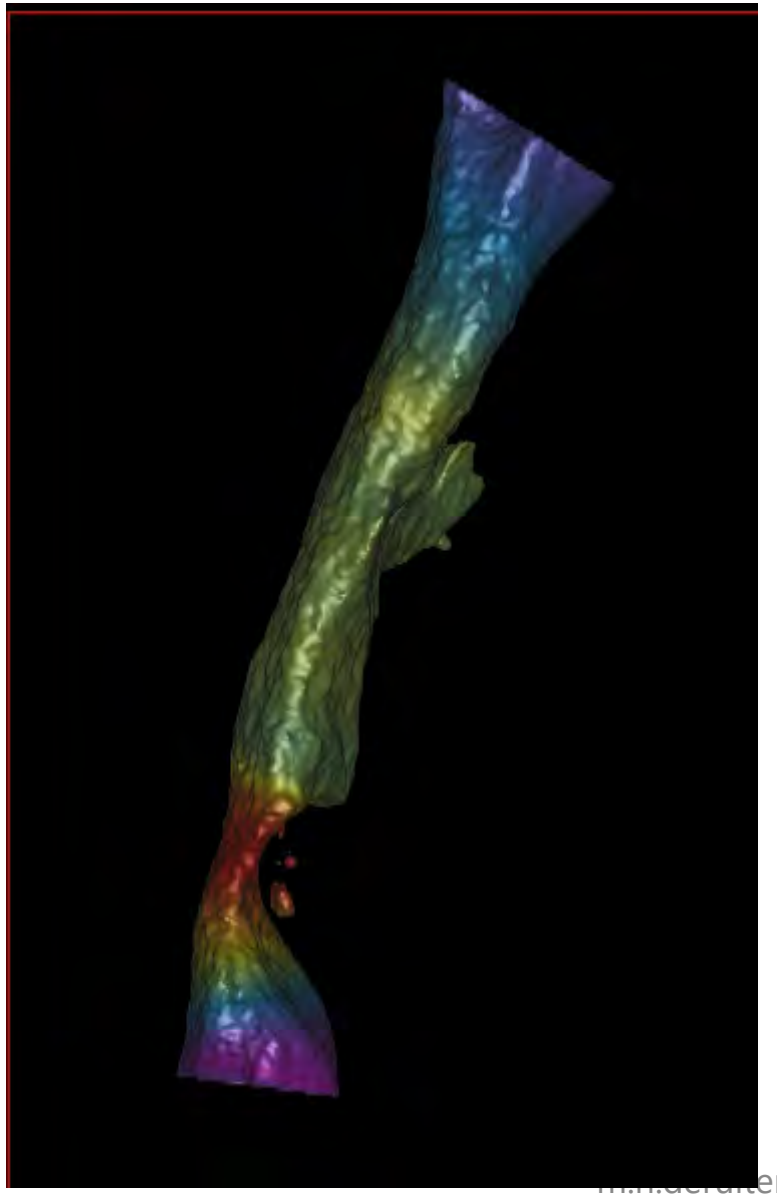


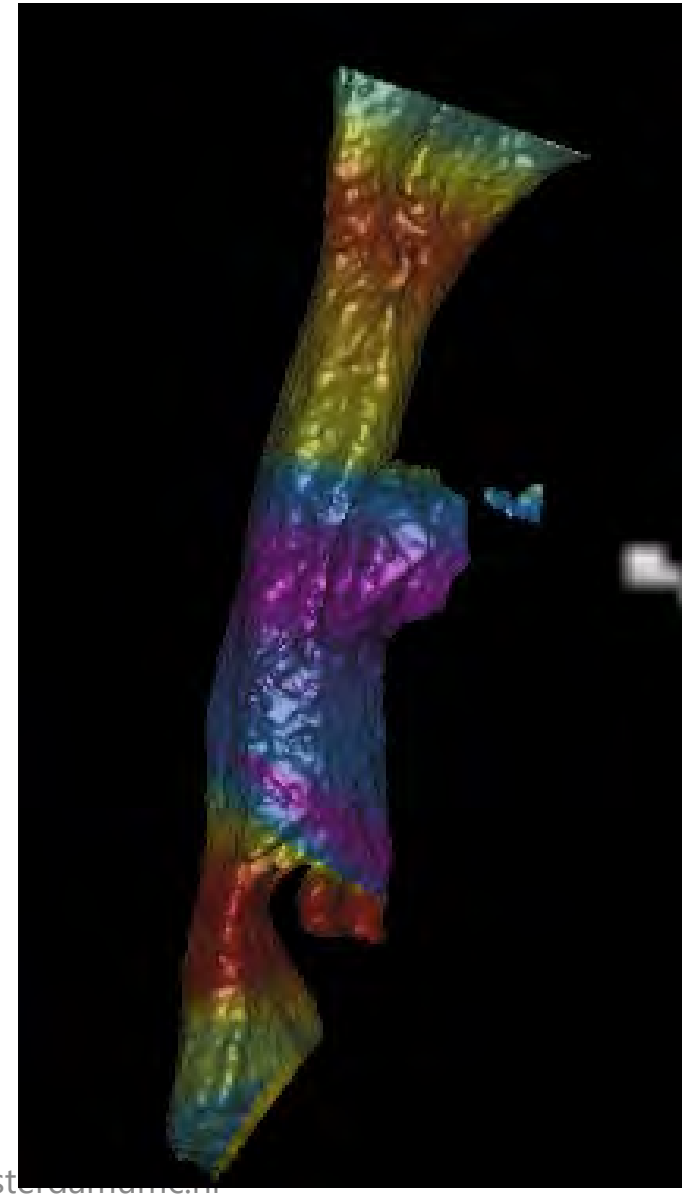


Edentulous case









Indicatie voor MMA

1. Matig-ernstige OSA (>15) ; hoe hoger, hoe beter ☺
2. CPAP intolerantie / falen
3. MRA intolerantie / falen
4. Leeftijd
5. Geringe mate van co-morbiditeit
6. Enige mate van retrognathie (terugliggende onderkaak)
7. Geen BMI restrictie
8. Bij voorkeur geen eerdere KNO-ingrepen

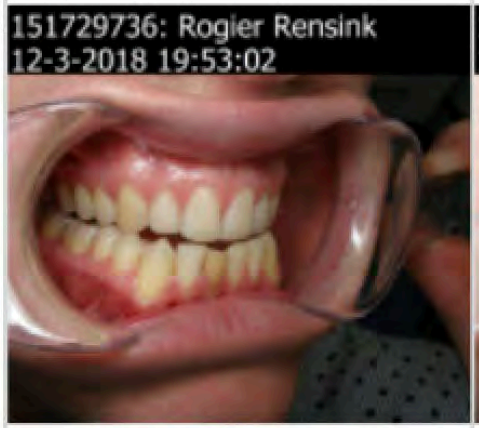
9. Mijn behandelplanning: "*maximaal naar voren, met behoud van esthetiek*"

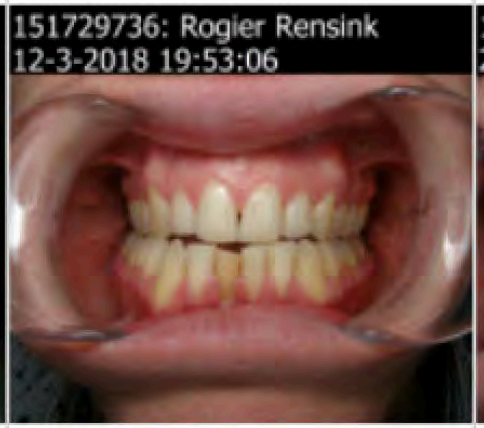
Patient R

Male
40 yrs ; AHI 3
MAD worked but now no OSA anymore

Wish for correction

PDF





28-12-2021

28-12-2021 - - Medische beelden

28-12-2021 - - Medische beelden

28-12-2021 - - Medische beelden

28-12-2021 - - Medische beelden

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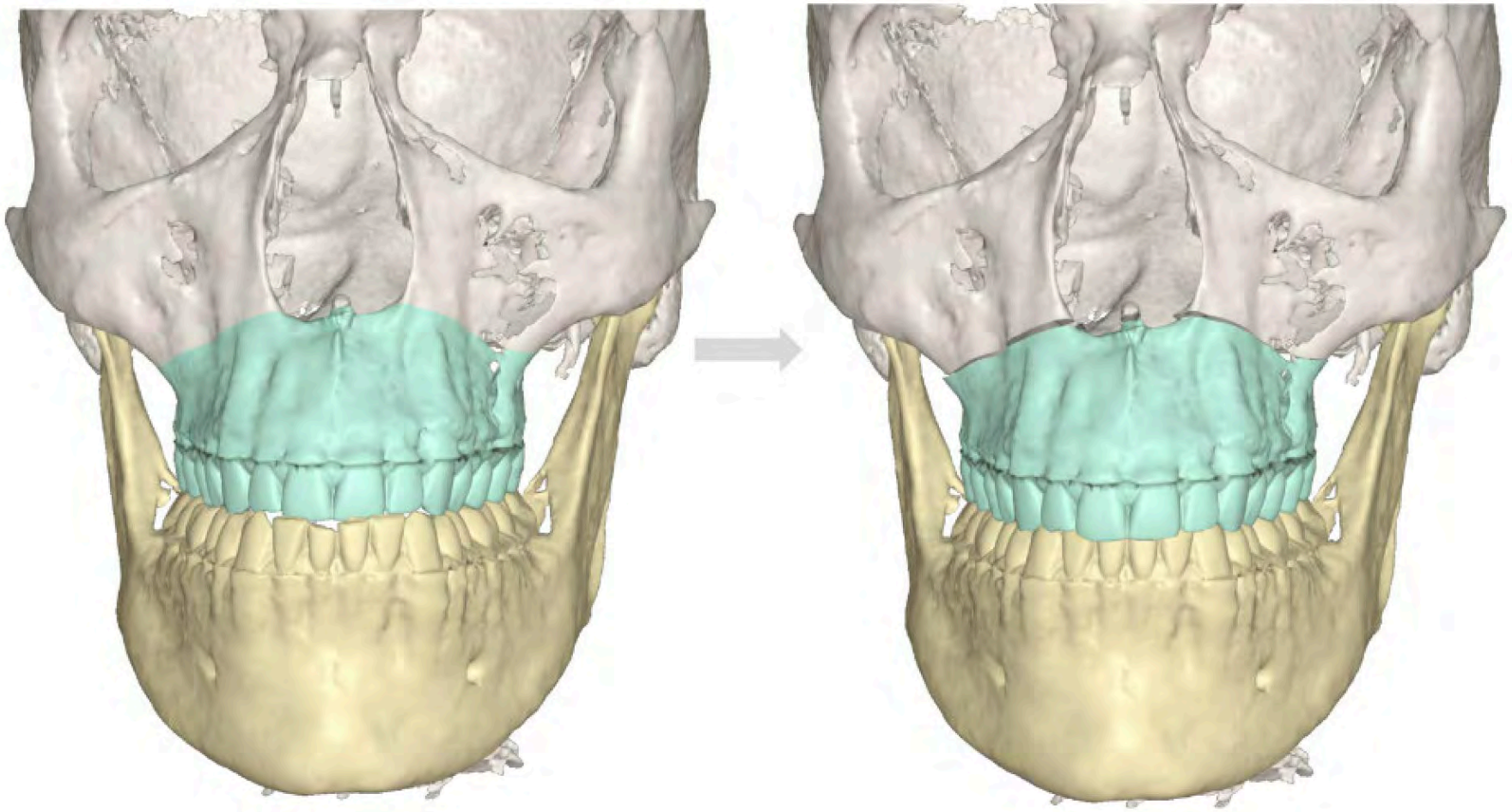
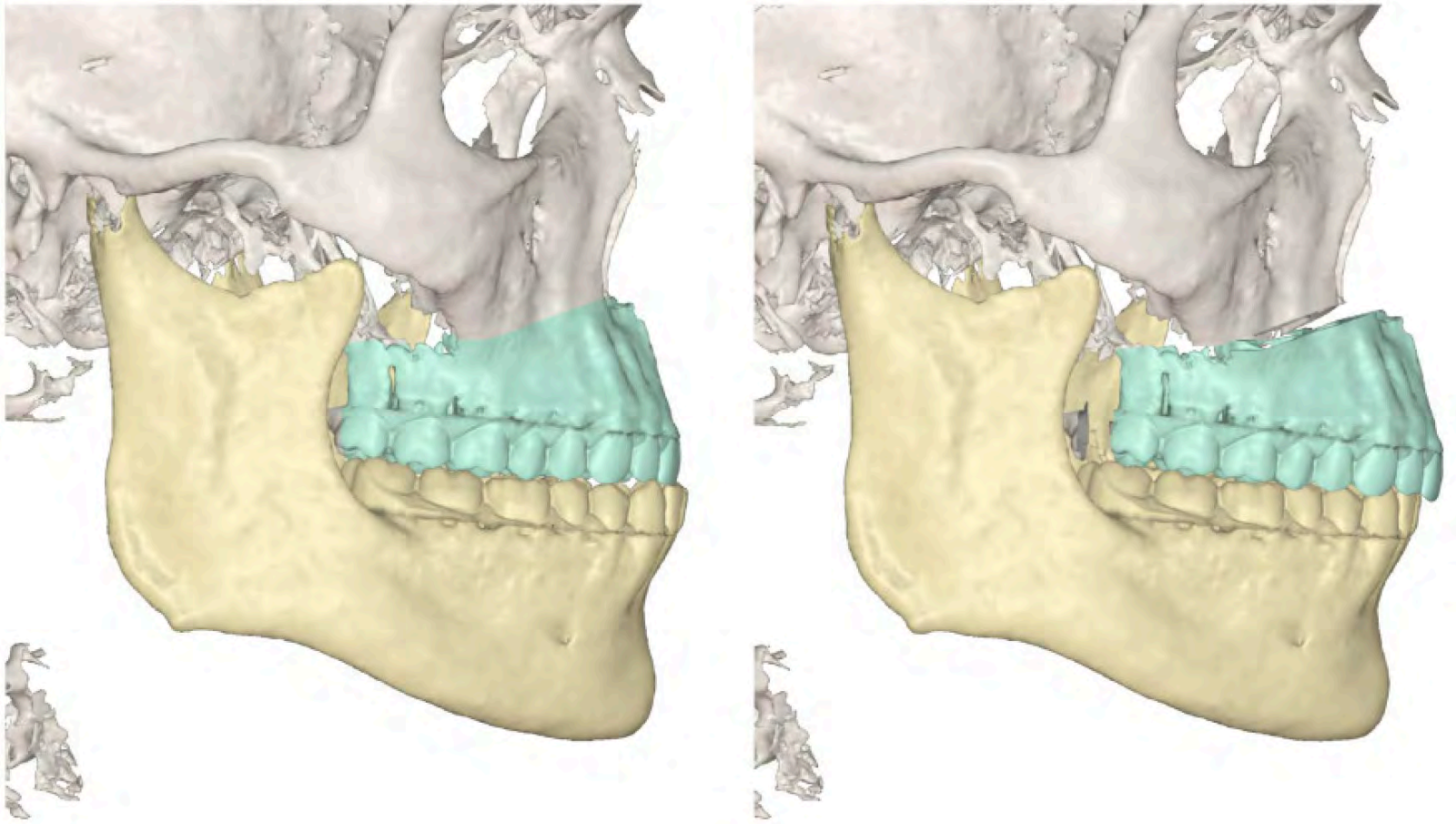
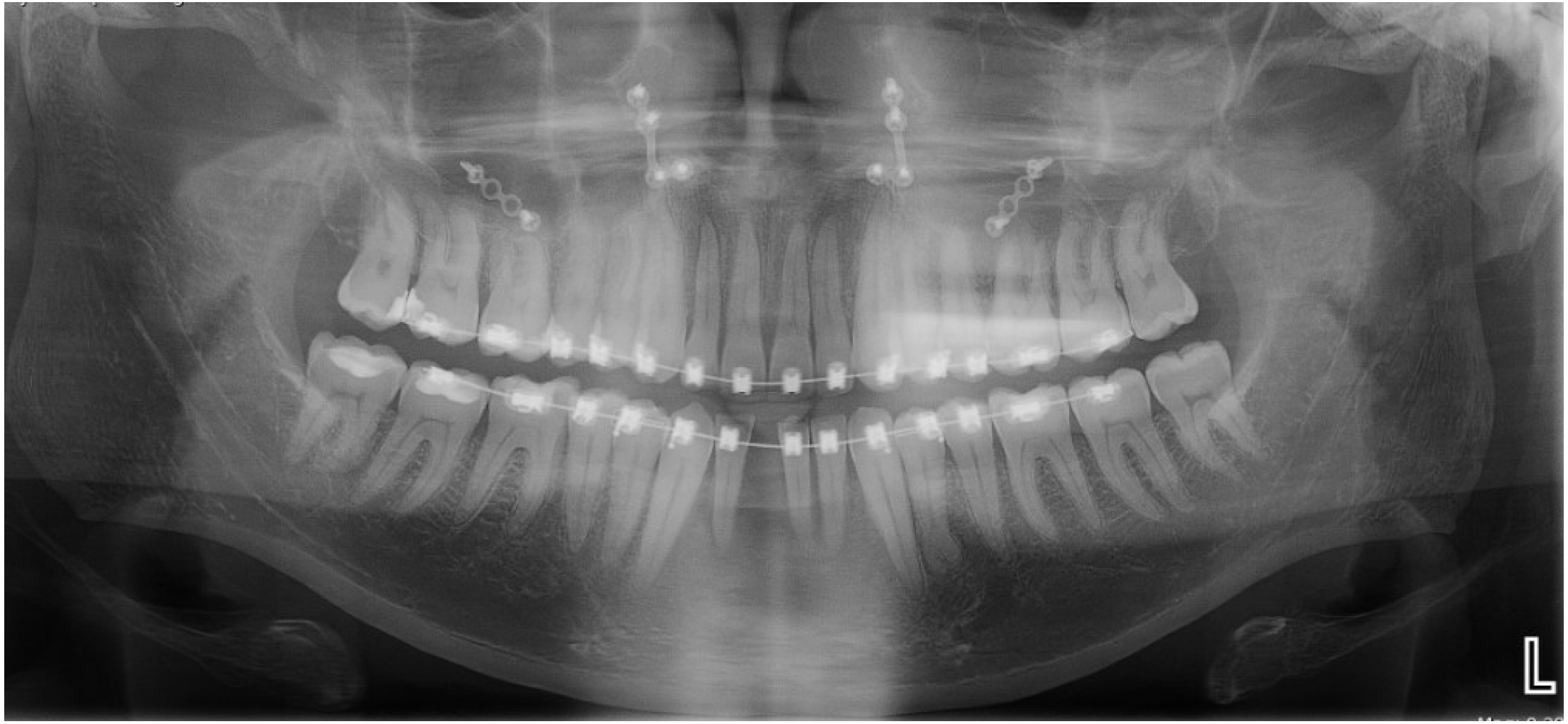
28-12-2021 - - Medische beelden


Date: 10/03/22
Time: 15:56:48

PLANNING SUMMARY







Nieuwe ontwikkelingen

Diakonessenhuis

Associatie van mondgezondheid en OSA (en MRA)

MOSA

Systematisch literatuur onderzoek
Start cohort 2025

Diakonessenhuis

QOMAS

- 80 patiënten
- Observationeel cohort
- 6 vragenlijsten: SF-36, ESS, OQLQ, OHIP-14, FOSQ en EQ-5D-3L
- Prospectief
- Pre operatief tot 3 jaar follow up.

Haya Al-Bayyati
Geneeskunde student - UvA

Diakonessenhuis

NIH U.S. National Library of Medicine
ClinicalTrials.gov

MEC-U
MEDICAL RESEARCH ETHICS COMMITTEES UNITED

RETRO-QOMAS

- circa 60 patiënten
- Observationeel cohort
- 6 vragenlijsten: SF-36, ESS, OQLQ, OHIP-14, FOSQ en EQ-5D-3L
- Retrospectief
- Alleen post-operatief

Hartelijk dank voor uw aandacht!

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osas@diakhuis.nl