

Maurits de Ruiter, MKA-chirurg

Cursus OSA – MRA

(Tandheelkundige Slaapgeneeskunde)

Van der Valk Hotel Houten, 29 oktober 2026
mdruiter@diakhuis.nl



CV

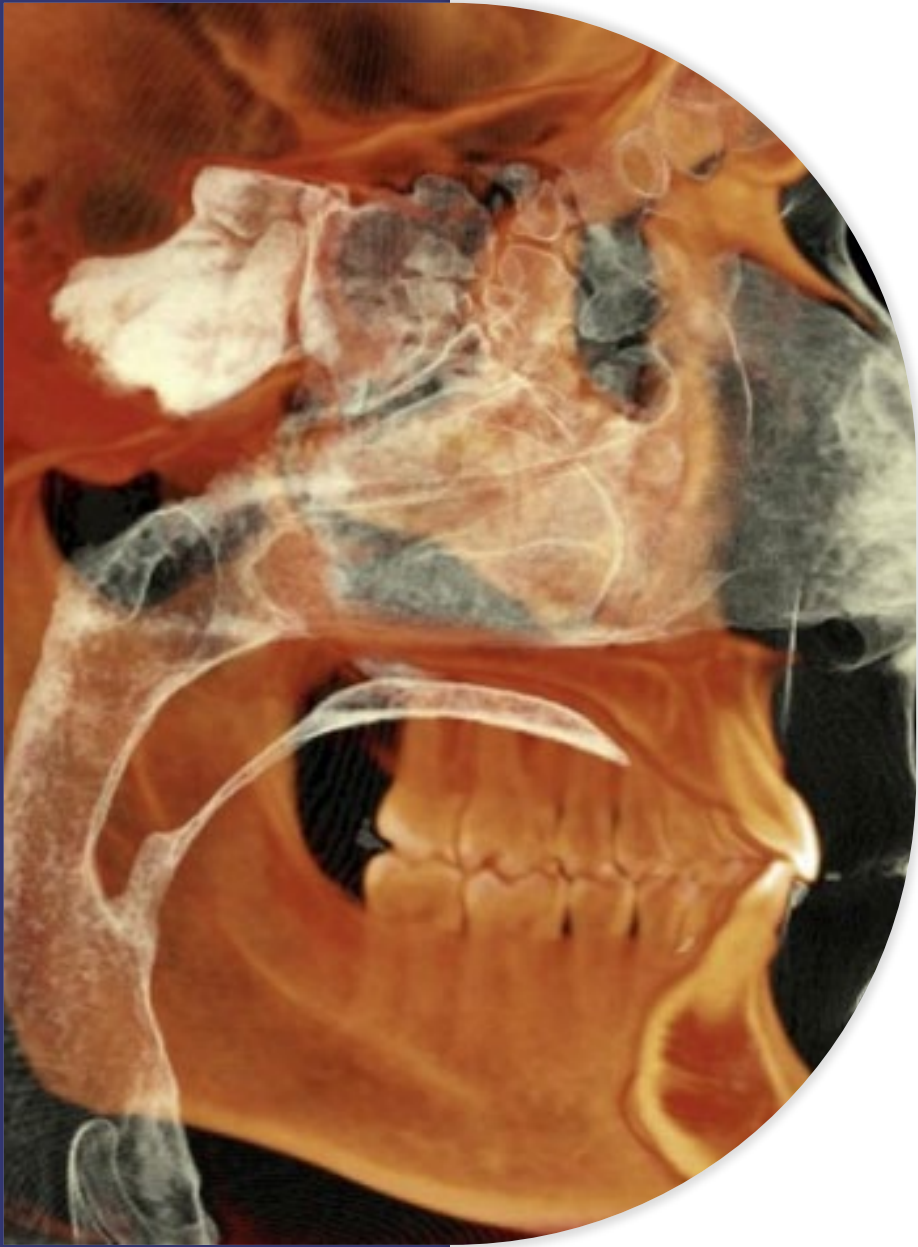
- Tandarts: Radboud University Nijmegen
- Arts: Amsterdam University Medical Center
- MKA-chirurgie opleiding: Amsterdam UMC

MKA-chirurg in het Diakonessenhuis Utrecht/Zeist en in samenwerking met het UMC 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 onderzoeksgeld² • Honorarium of andere (financiële) vergoeding³ • Aandeelhouder⁴ • Andere relatie, namelijk ...⁵	Onderzoeksbeurs Diakonessenhuis Ja N.v.t. N.v.t.



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/>



PATIENT

Hoofdklacht!!!!

SNORING

APNOEA

CVD

HEADACHE

TIREDNESS /
SLEEPINESS

CONCENTRATION

DEPRESSION /
PSYCH

ABILITY TO DRIVE

PATIENT

CHARACTERISTICS

GENDER

AGE

BODY WEIGHT

COMORBIDITY

MEDICATION

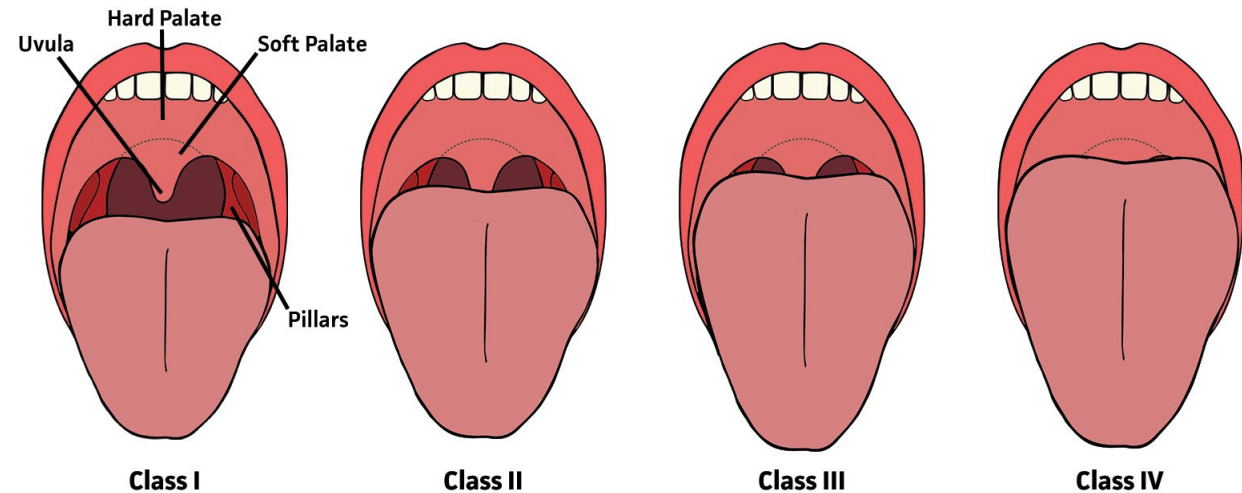
**RELATION -
PARTNER**

**JOB – DAILY
FUNCTIONING**

STRESS - PSYCH

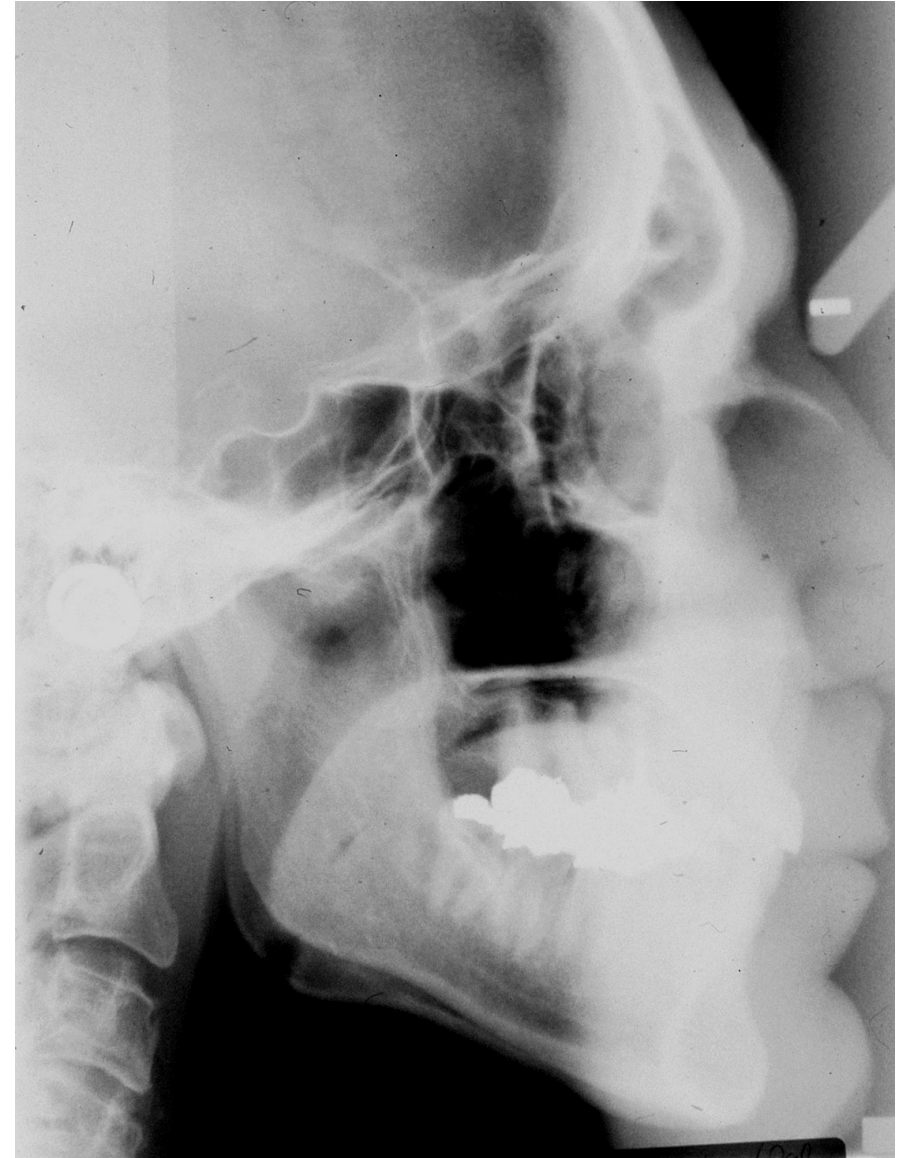
KNO onderzoek

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



Tandheelkundig onderzoek

- Tandem / 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.,

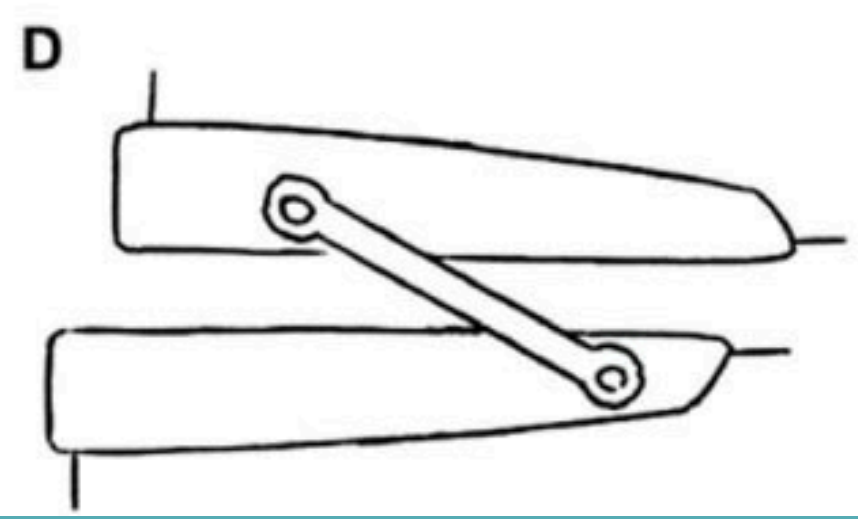
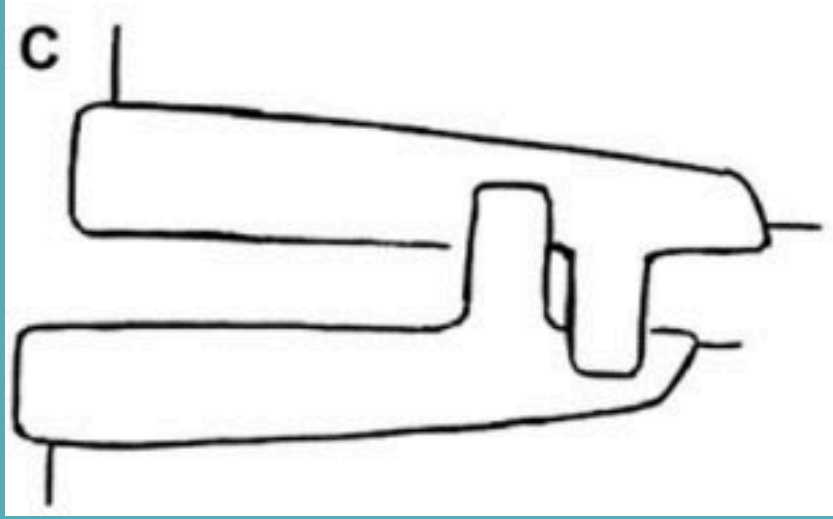
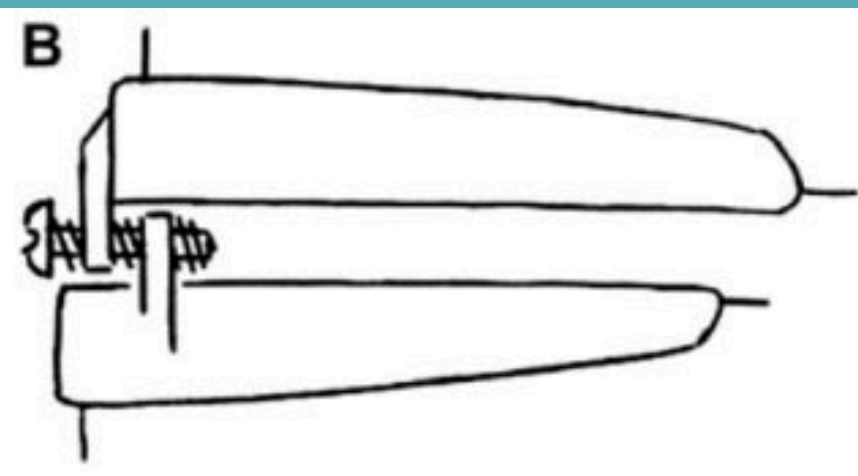
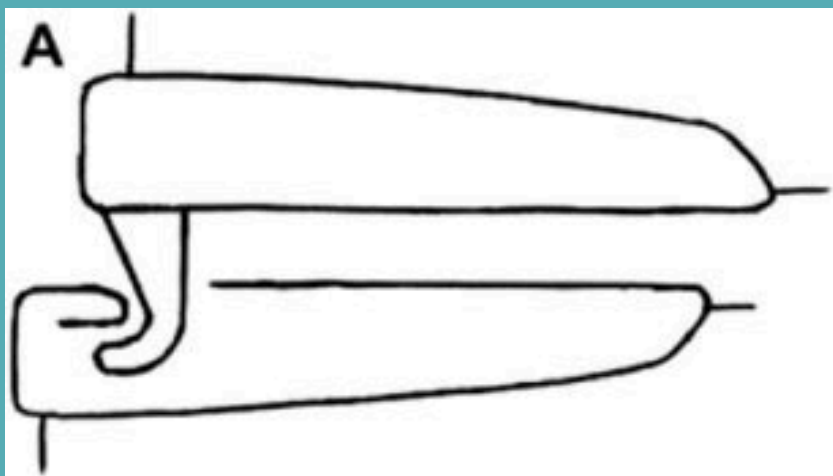


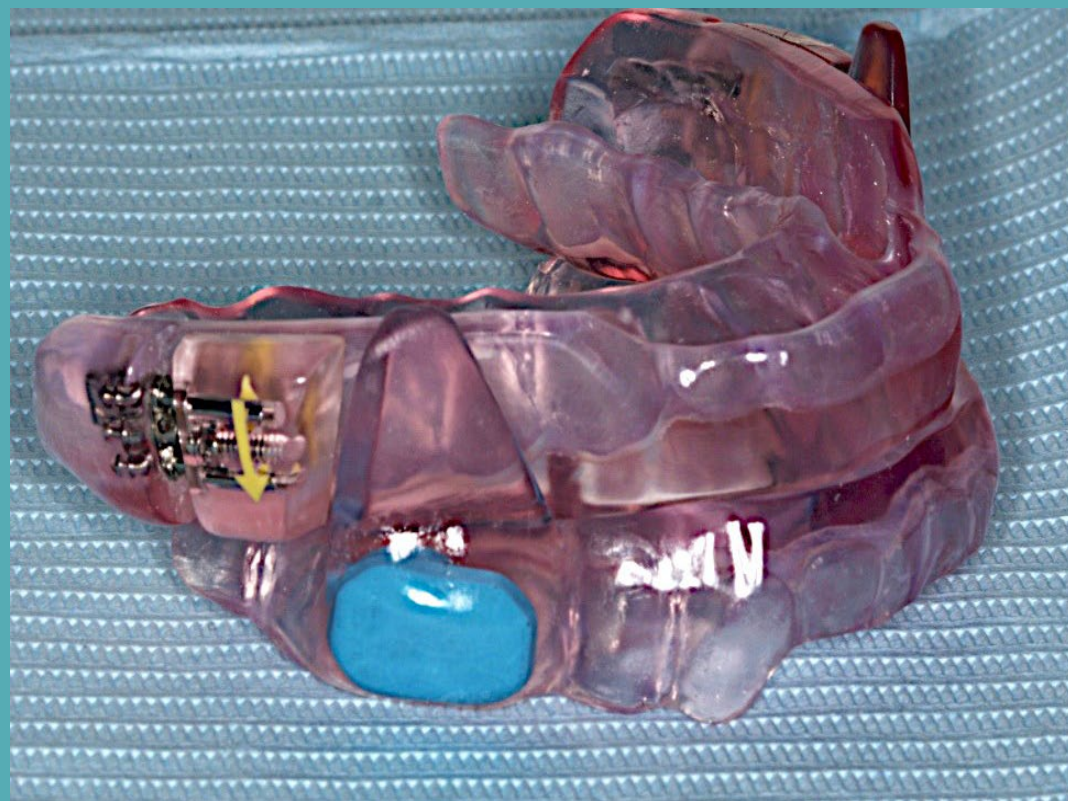
PMKC
28-08-2014

25-10-14
09:00

Ma
ANT







**Somnomed
Prosomnus
Resmed**



MRA aantallen Diak

2018: 3 (flex)

2019: 67 (flex en fusion)

2020: 123 (flex, fusion)

2021: 185 (fusion en avant)

2022: 213

2023: 255

2024: 260 (214 somnoms, 42 prosomnus, 4 Resmed Narval)

2025: 328 (147 somnoms, 160 prosomnus, 21 Resmed Narval)

2026 (tot nu toe): : 307 (137 somnoms, 121 prosomnus, 49 Resmed Narval)



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

Types of Oral Appliances for Obstructive Sleep Apnea



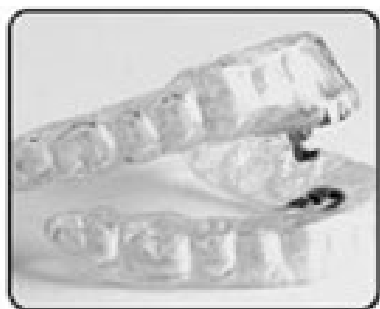
Klearway



Somnomed



Herbst



Tap



Suad









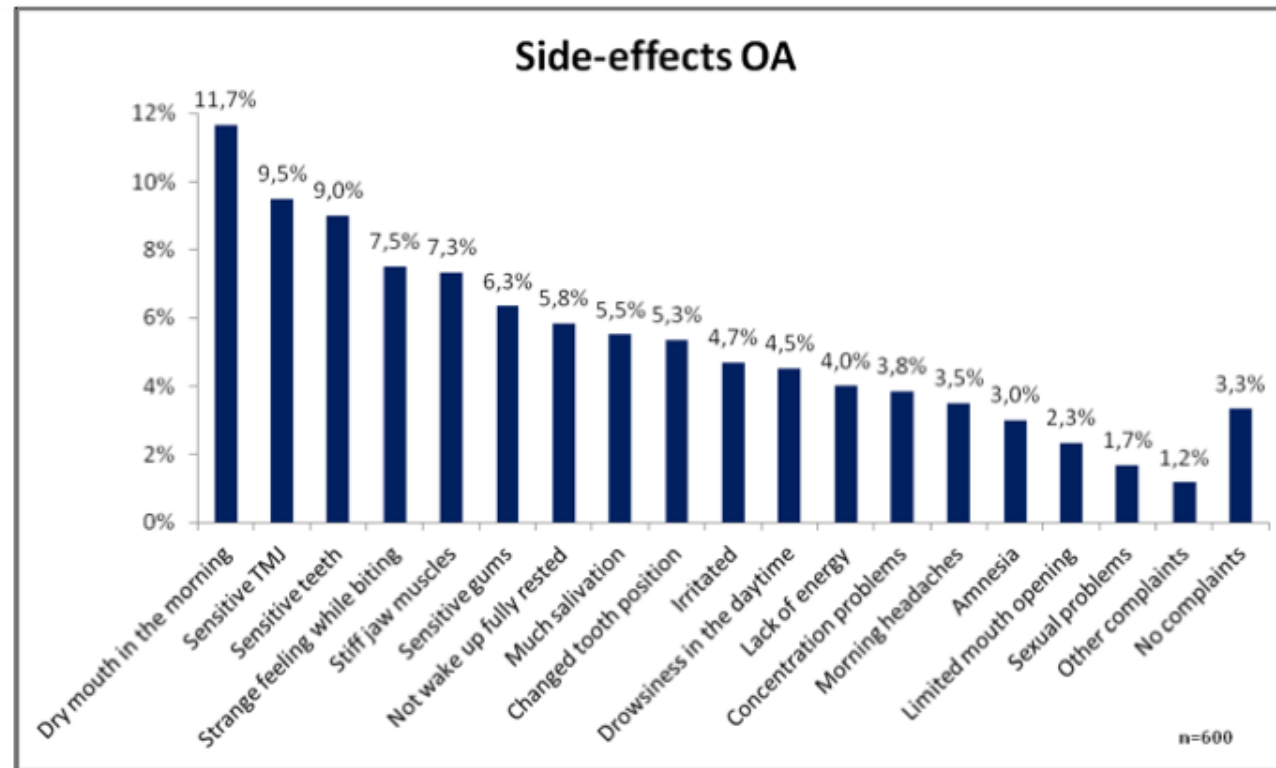




Snorex

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

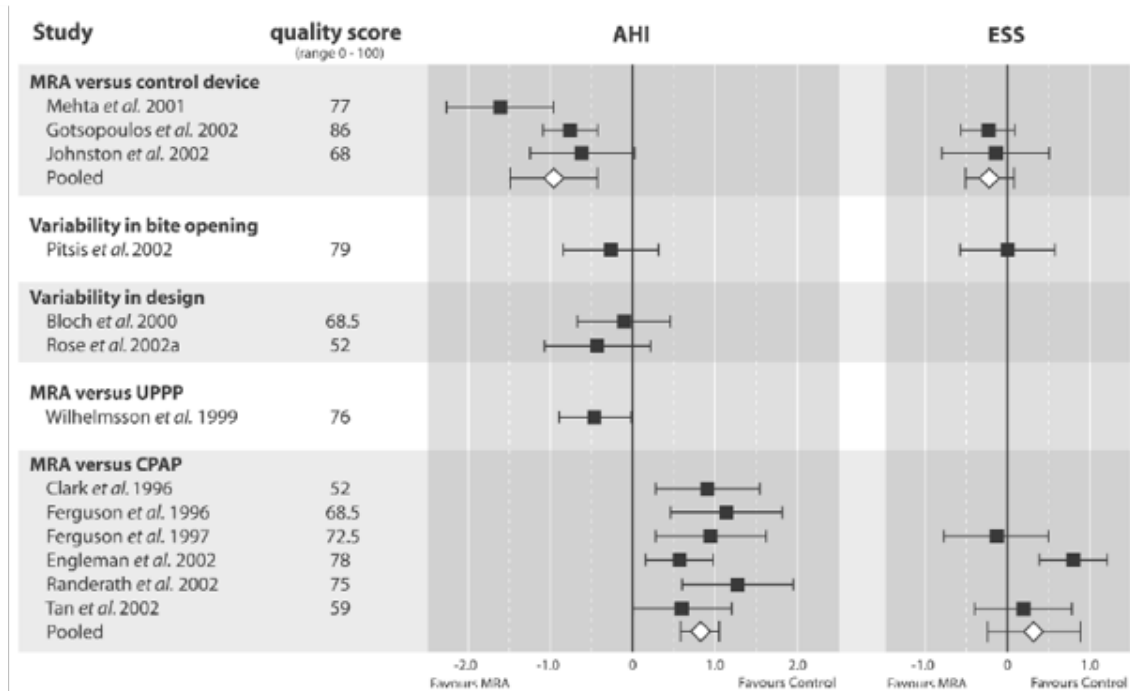
Ten slotte wordt opgemerkt dat er naast het MRA nog andere “oral appliances” voor de behandeling van OSAS bestaan. Het “tongue-retaining device” (TRD) is ontworpen om de tong ter verbetering van de luchtwegdoorgankelijkheid in een voorwaartse stand te fixeren. Het effect van dit apparaat op de AHI is 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 patiëntcompliance 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.



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

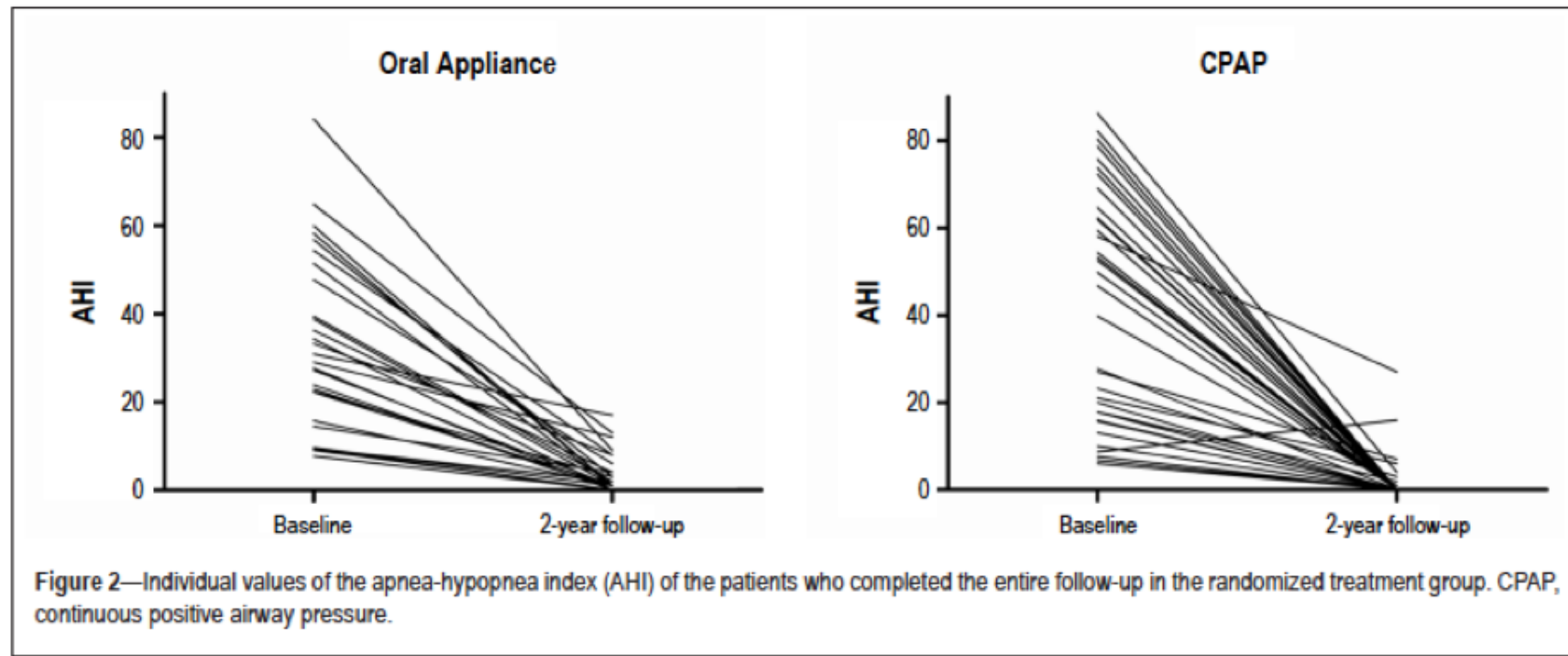
Side Effects

- Dry mouth
- Sensitive TMJ
- Sensitive teeth
- Stiff muscles
- Changed tooth position



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



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

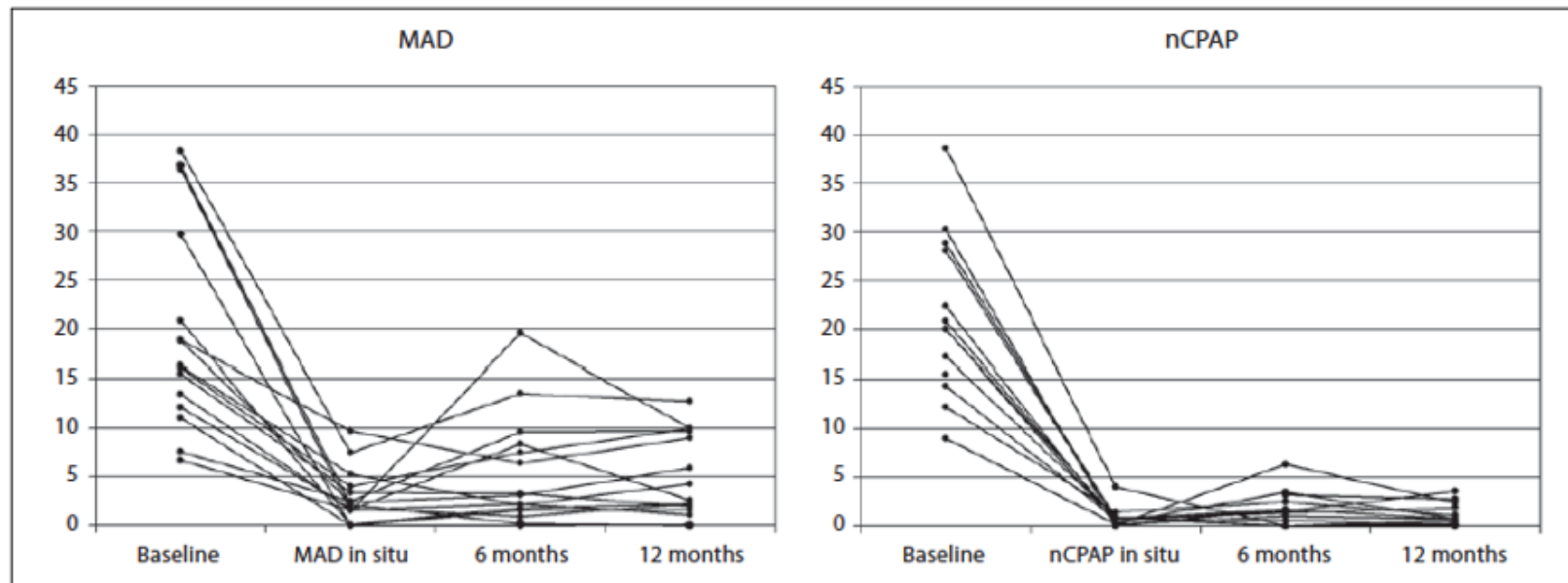
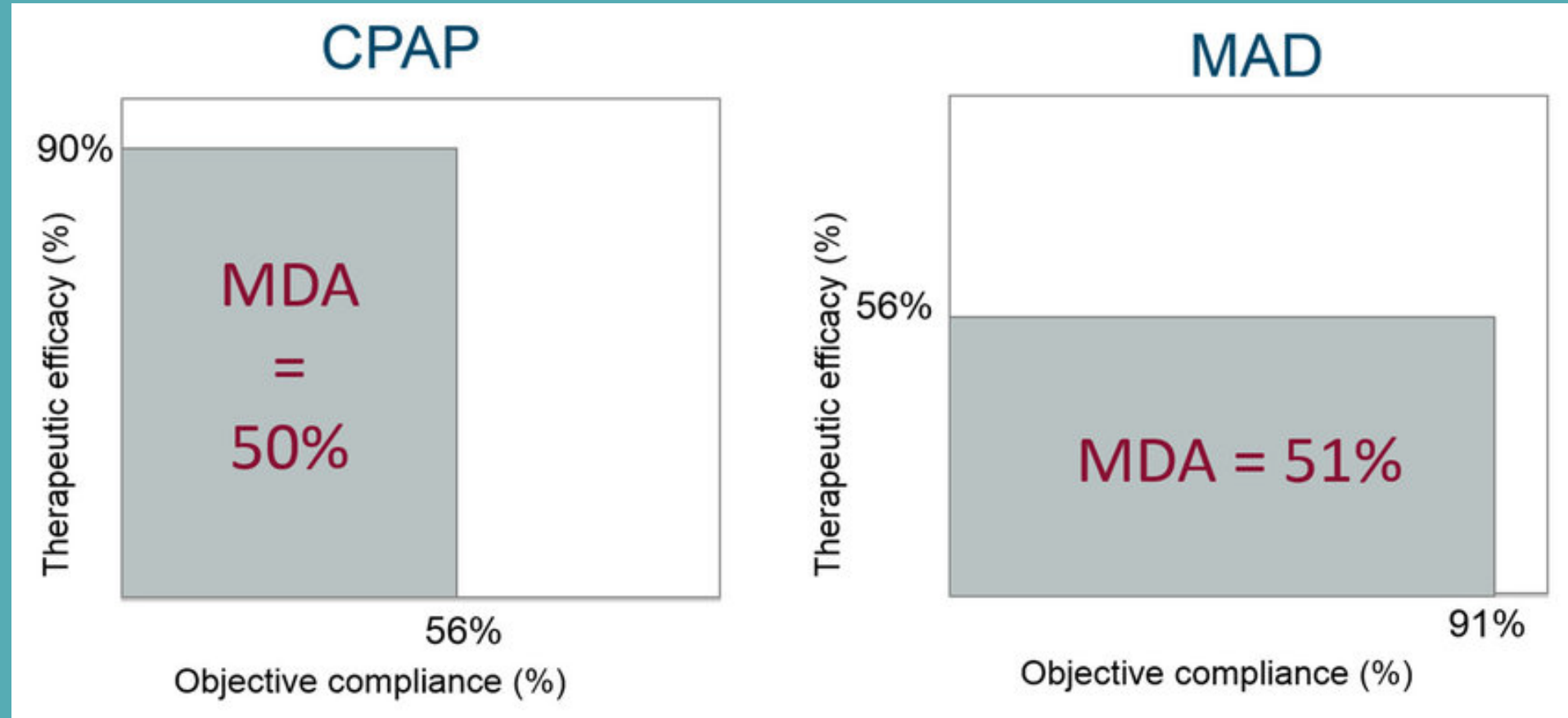


Fig. 2. Individual values of the AHI of the 28 patients who completed the entire study protocol (MAD, n = 15; nCPAP, n = 13) obtained from the baseline PSG recordings and from the subsequent therapy evaluation PSG recordings.

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%	<i>P</i> 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

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
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Craniomandibular Dysfunction

Limitations

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

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

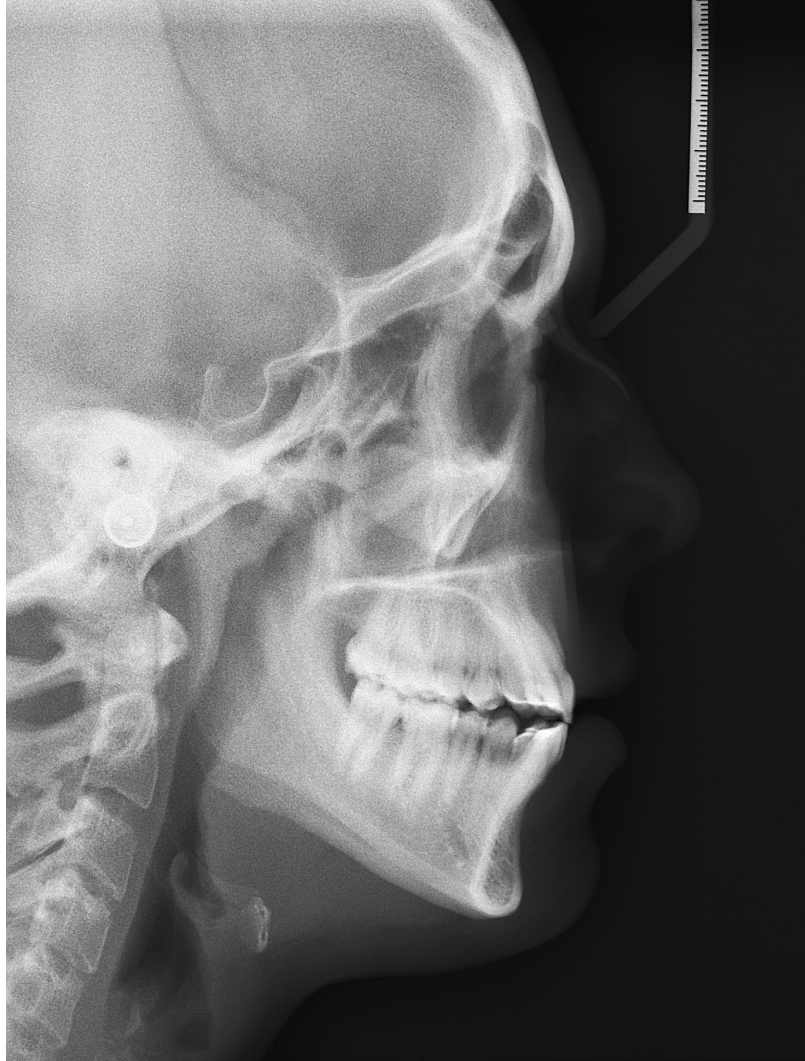
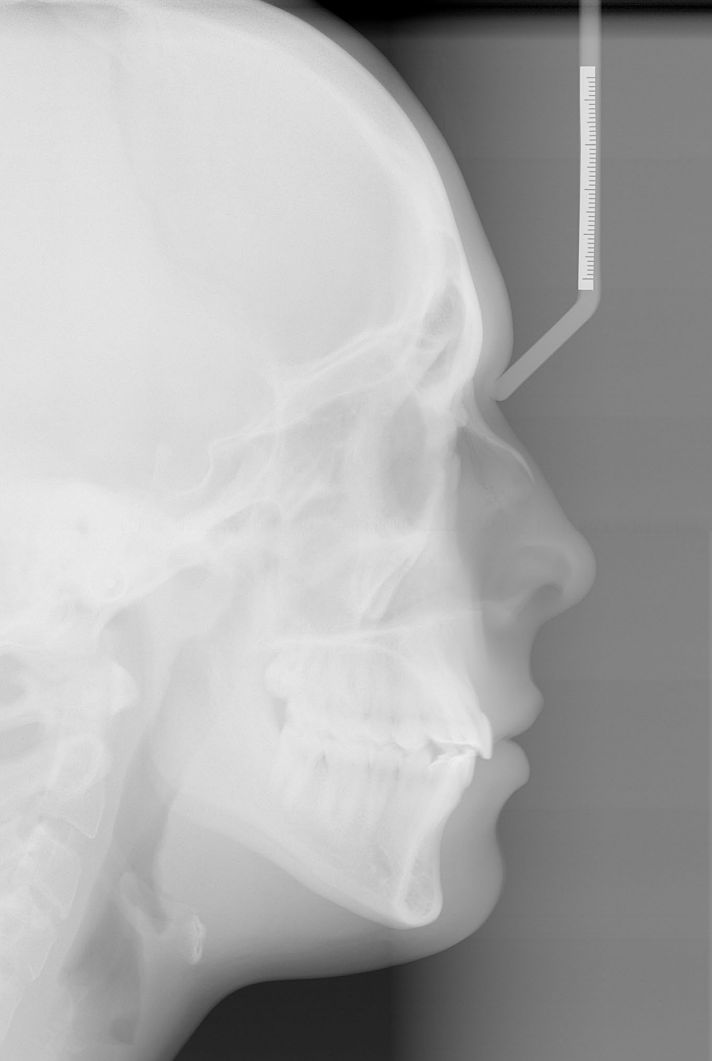
M. H. J. Doff • K. J. Finnema • A. Hoekema •
P. J. Wijkstra • L. G. M. de Bont • B. Stegenga

Received: 17 December 2011 / Accepted: 10 April 2012
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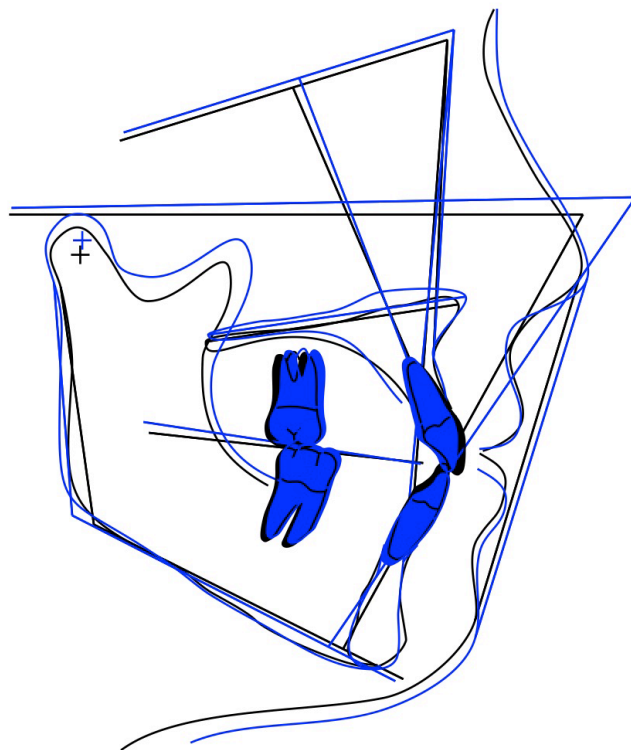
Dental changes in OAT

Limitations

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

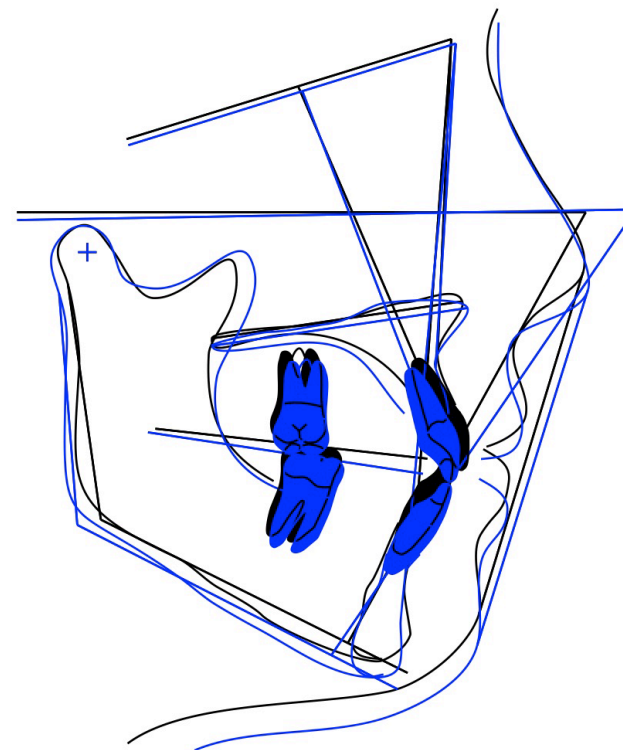


PNS-ANS@A-point (Auto)

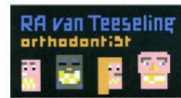


2013
2016

PNS-ANS@Hinge Axis (Auto)



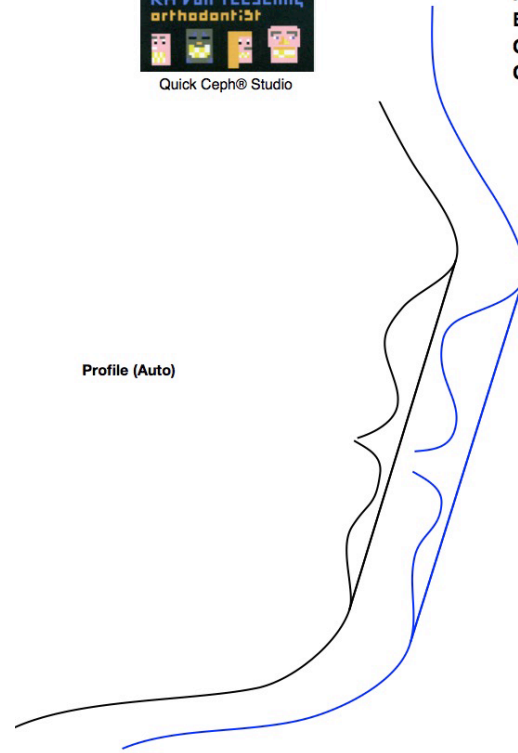
2013
2016



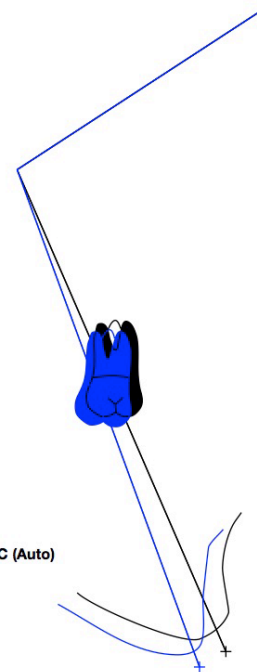
Quick Ceph® Studio

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

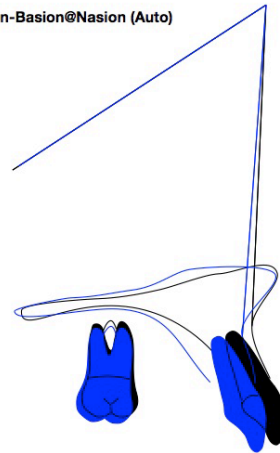
Profile (Auto)



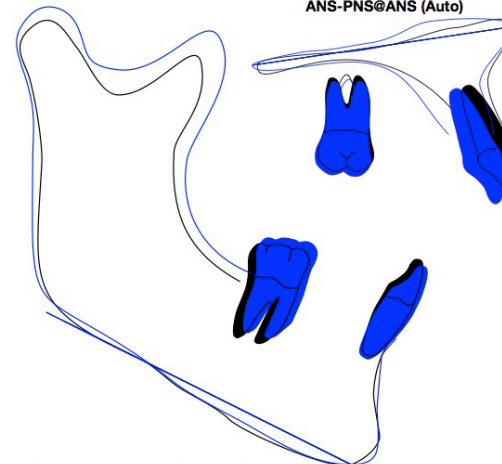
Nasion-Basion@CC (Auto)



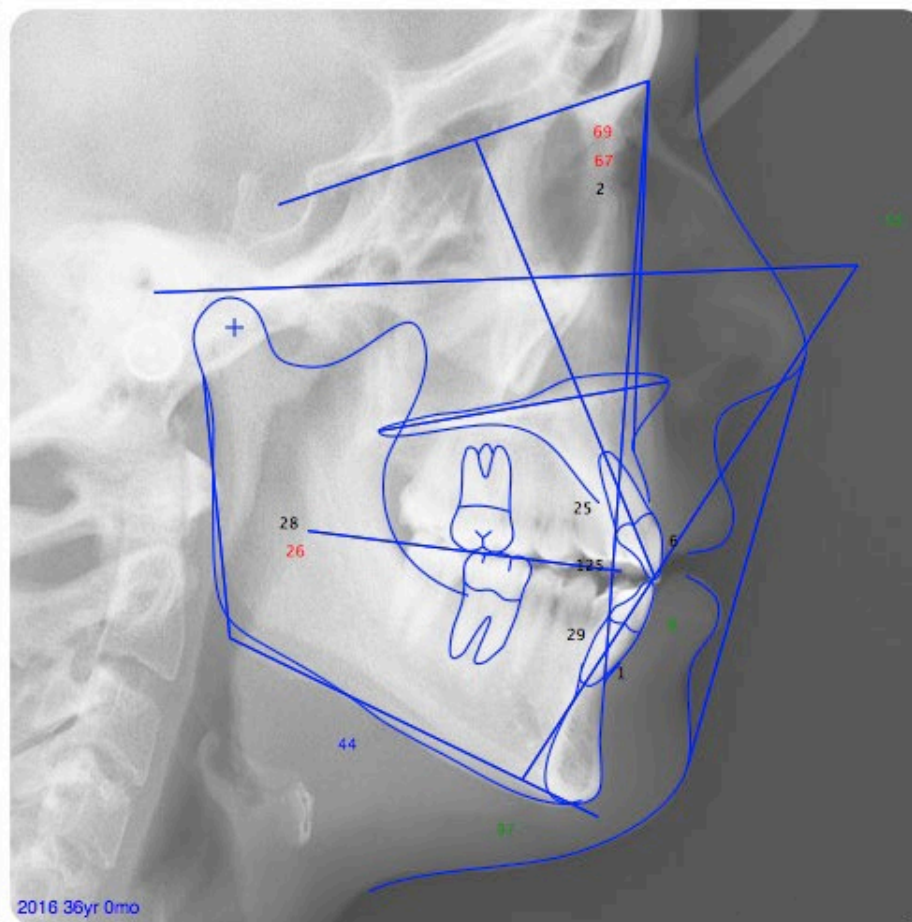
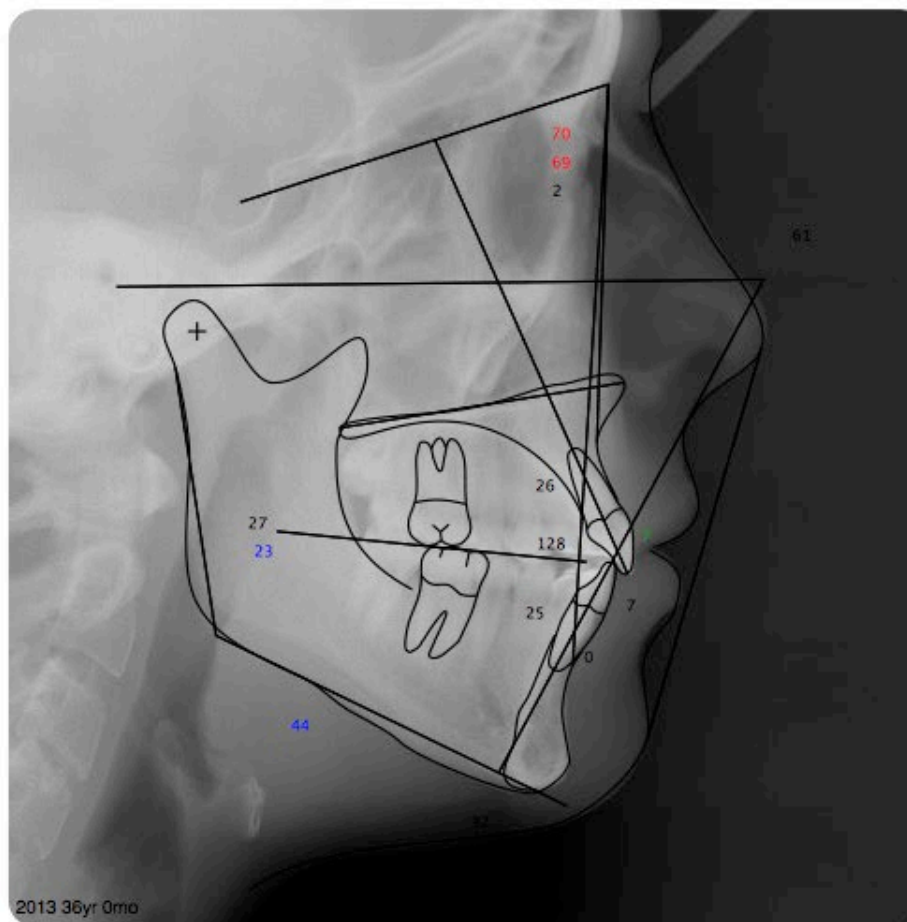
Nasion-Basion@Nasion (Auto)



ANS-PNS@ANS (Auto)



Corpus Left-Menton@Menton (Auto)



Temporomandibular Aspects in MAD treatment

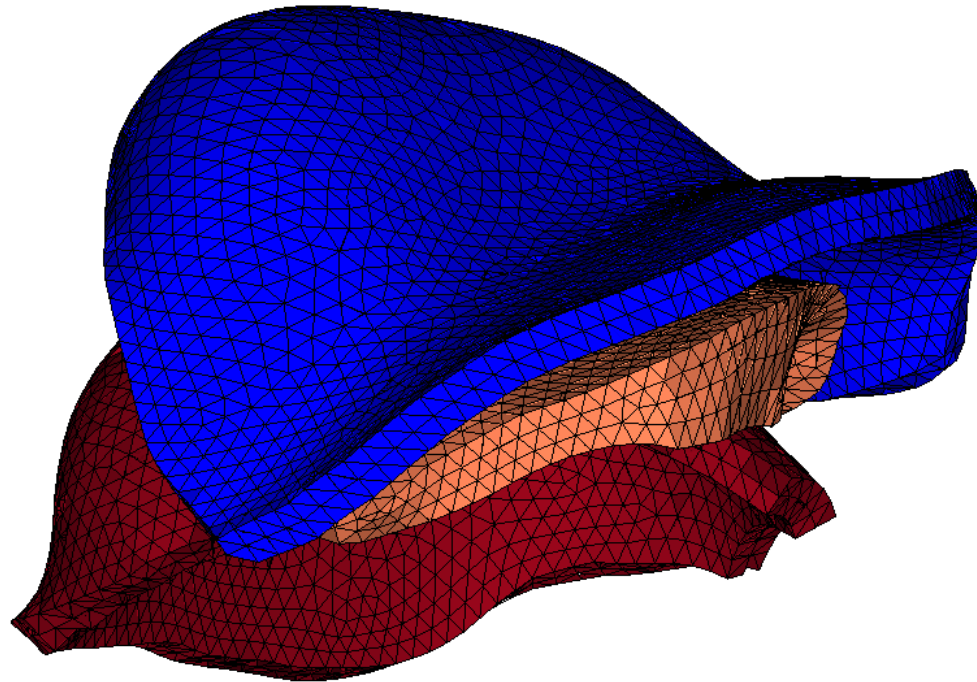
Finite element model

aantal elementen:

temporaal kraakbeen - 14500

discus - 12500

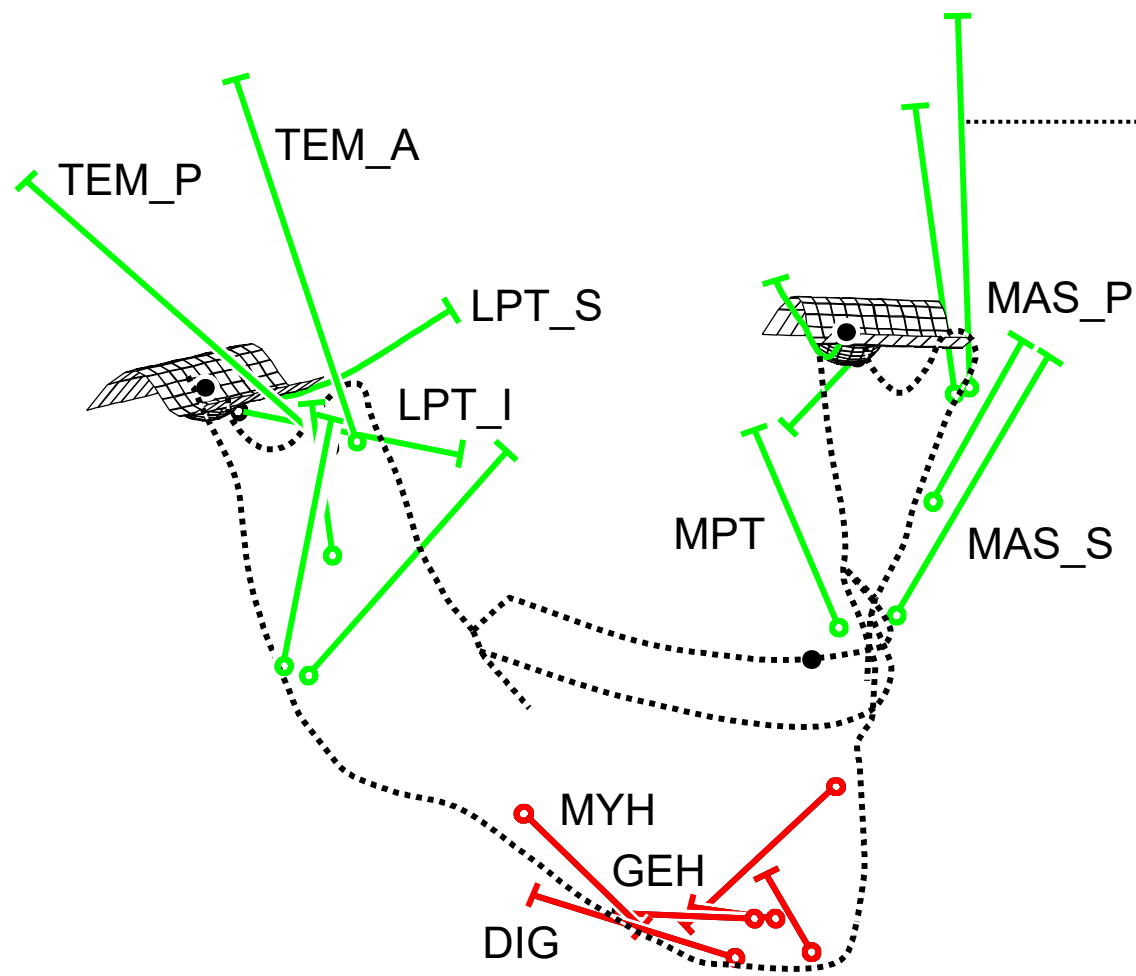
condylair kraakbeen - 12200



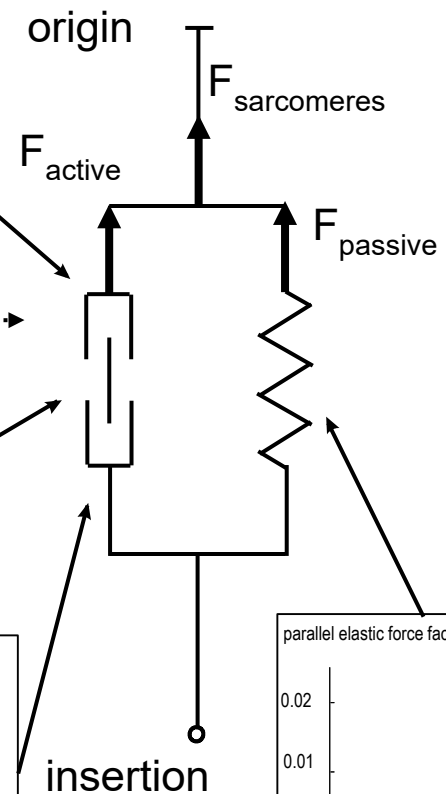
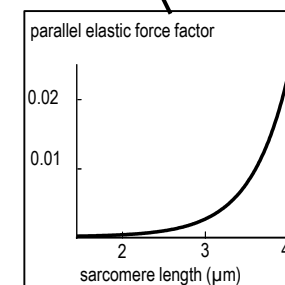
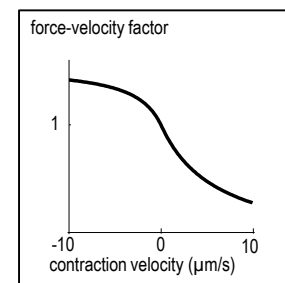
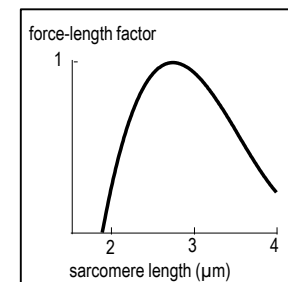
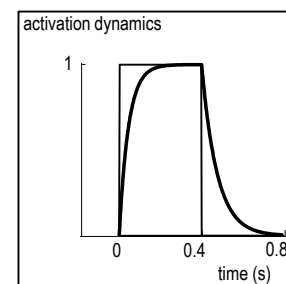
right-anterior view

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.

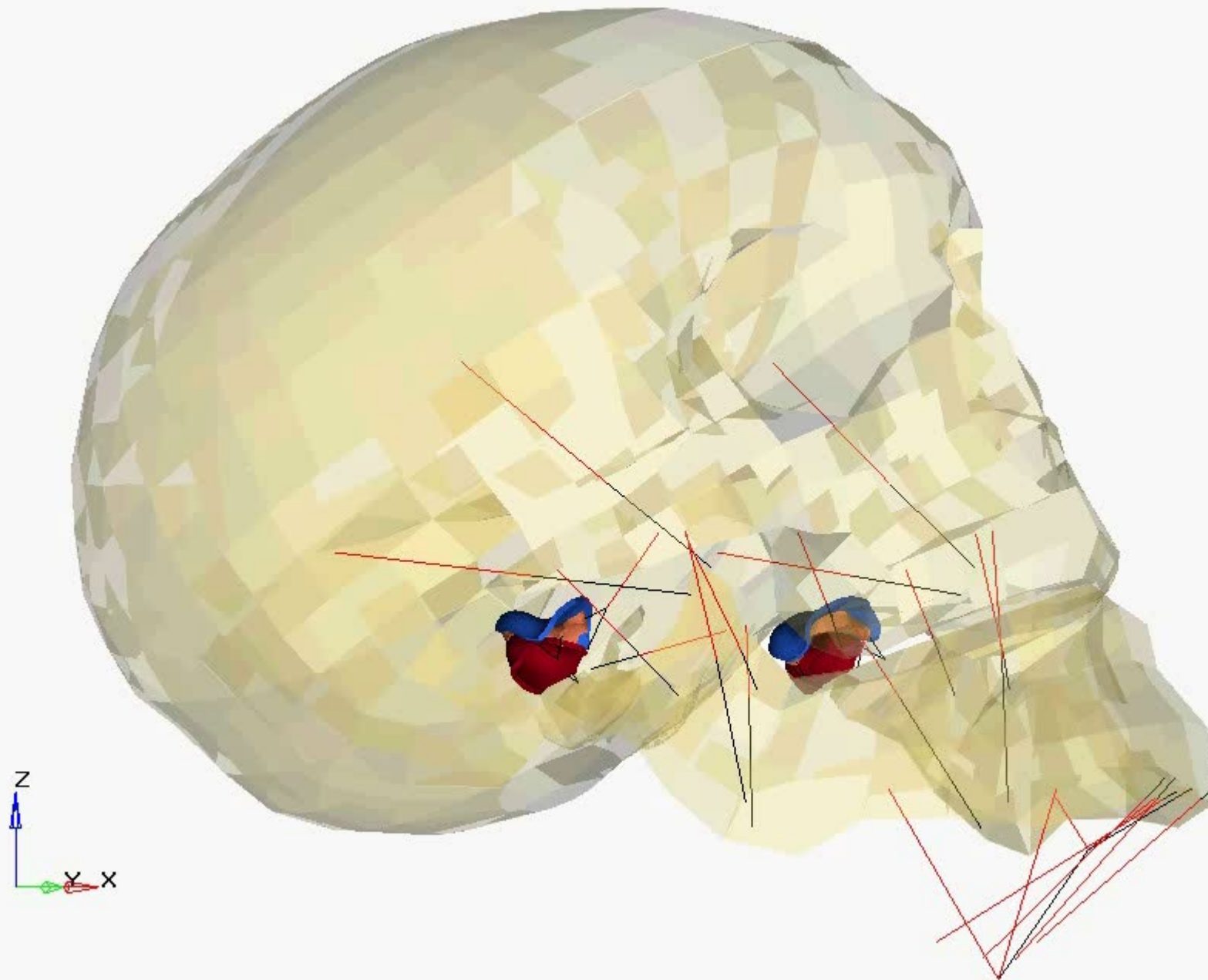
jaw model



muscle model

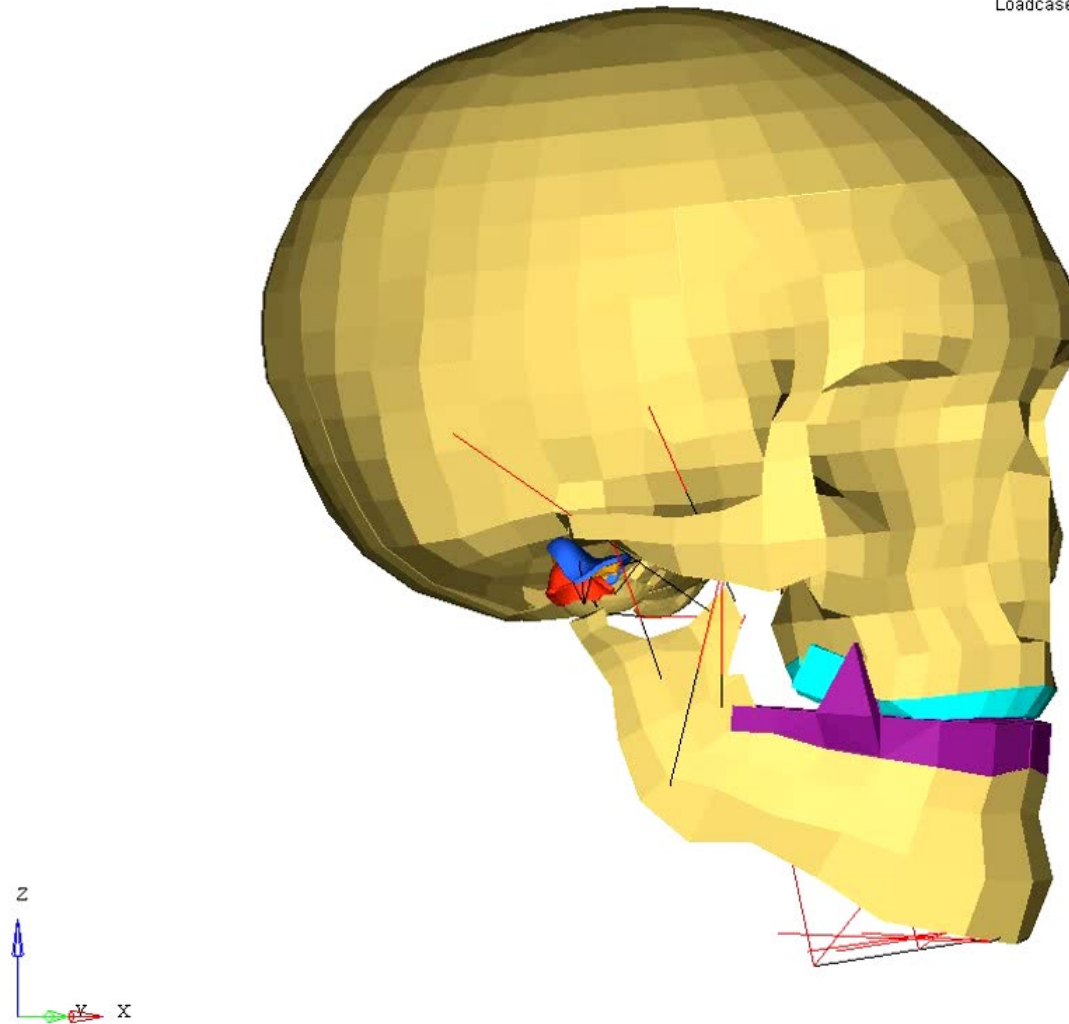


Time = 0.004000



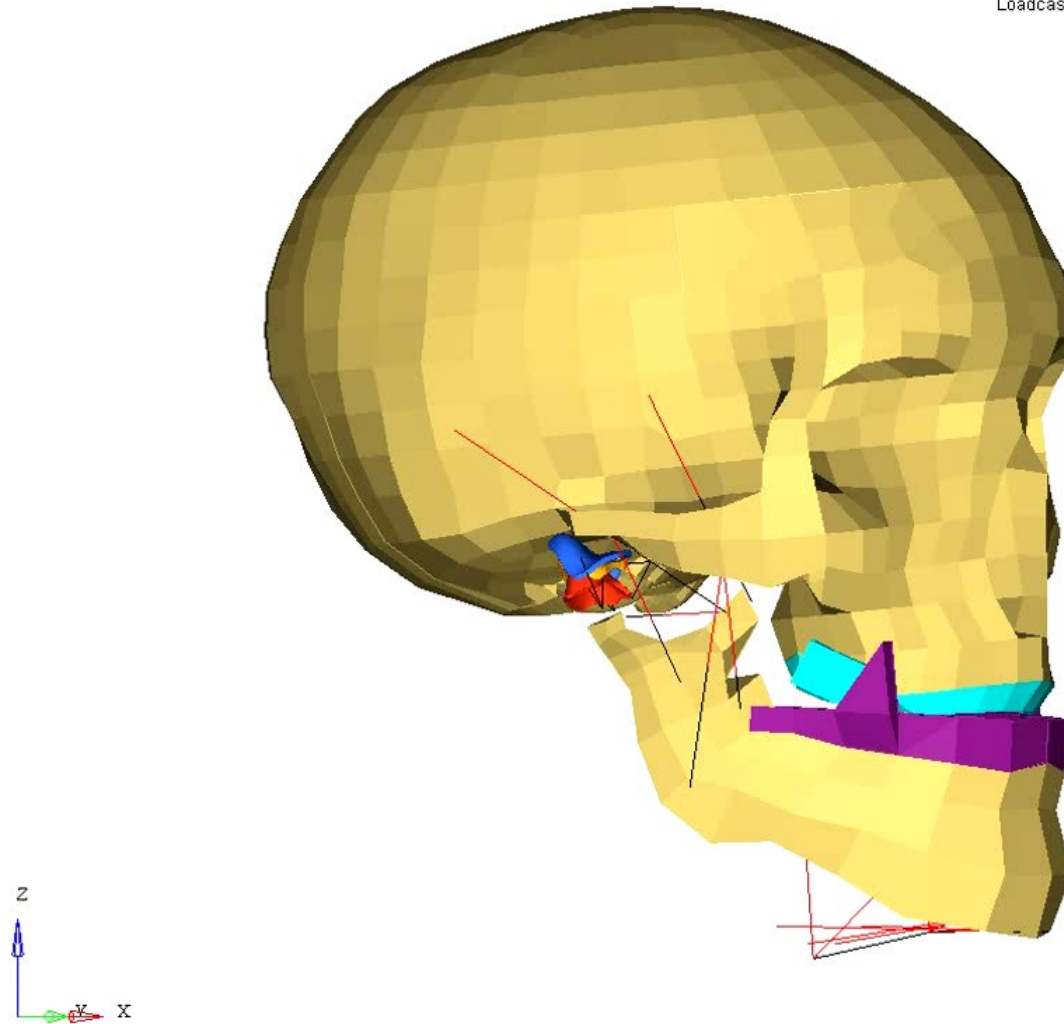
Open and close

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Loadcase 1 : Time = 0.180000 : Frame 19

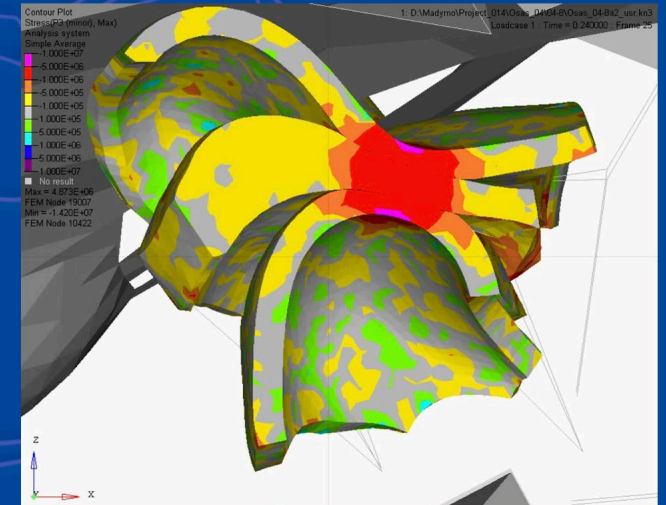
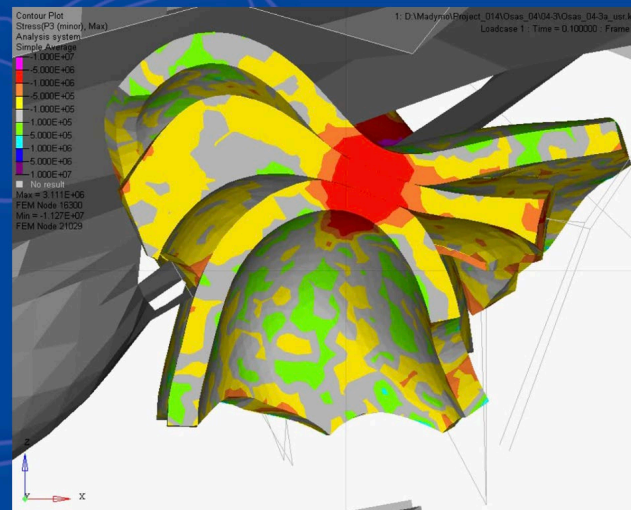
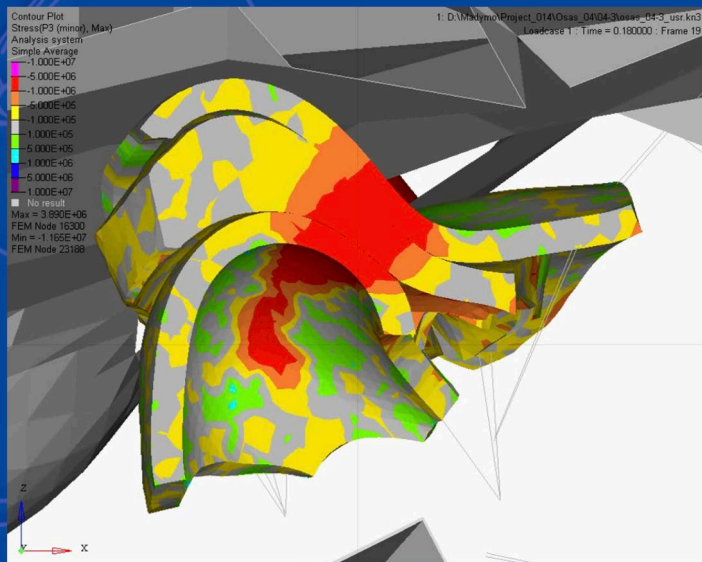


5.2 mm protrusion

1: D:\Madymo\Project_014\Osas_04\04-8\Osas_04-8a2_usr.kn3
Loadcase 1 : Time = 0.240000 : Frame 25



Tension in Joint



Conclusion

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



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



DENTISTRY • REVIEW

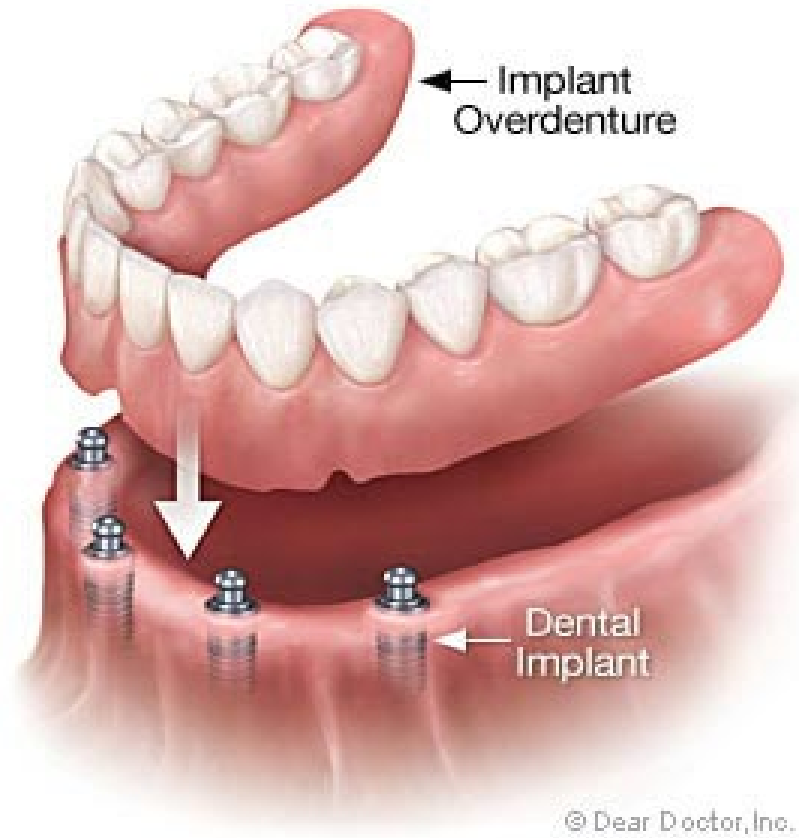
Management of obstructive sleep apnea in edentulous patients: an overview of the literature

David S. P. Heidsieck¹ • Maurits H. T. de Ruiter¹ • Jan de Lange¹

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

De edentate patiënt met een mandibulair repositieapparaat

Samenvatting Obstructieve slaapapneu is een veelvoorkomende aandoening, waarbij een aanzienlijk deel van de patiënten tandeloos is. Continuous positive airway pressure is de gouden standaard in de behandeling van obstructieve slaapapneu, maar vanwege de lage therapietrouw aan deze behandelingsmethode wordt vaak naar een alternatieve therapie gezocht. Het mandibulair repositieapparaat is een potentiële oplossing, maar wordt niet overwogen als therapie bij edentate patiënten vanwege een vermeend retentie- en stabiliteitsgebrek. Aan de hand van een literatuuroverzicht omtrent therapie met een mandibulair repositieapparaat bij edentate patiënten bij wie obstructieve slaapapneu is vastgesteld en een keuzehulp wordt een handreiking gegeven voor behandelaren. Er is gebruikgemaakt van de PRISMA-guidelines voor een scoping review. Literatuur is verkregen uit de MEDLINE-database. Het onderzoek suggereert dat de therapie positief resultaat levert bij edentate patiënten met obstructieve slaapapneu, waarbij in alle geïnccludeerde artikelen een afname van de apneu-hypopneu-index werd beschreven en weinig therapiegerelateerde problemen werden ondervonden.

Schotanus EMC, Al-Bayyati HHR, Koppendraaier L, van der Hoeve EP, de Ruiter MHT. De edentate patiënt met een mandibulair repositieapparaat. Ned Tijdschr Tandheelkd 2026; 133: 104-109

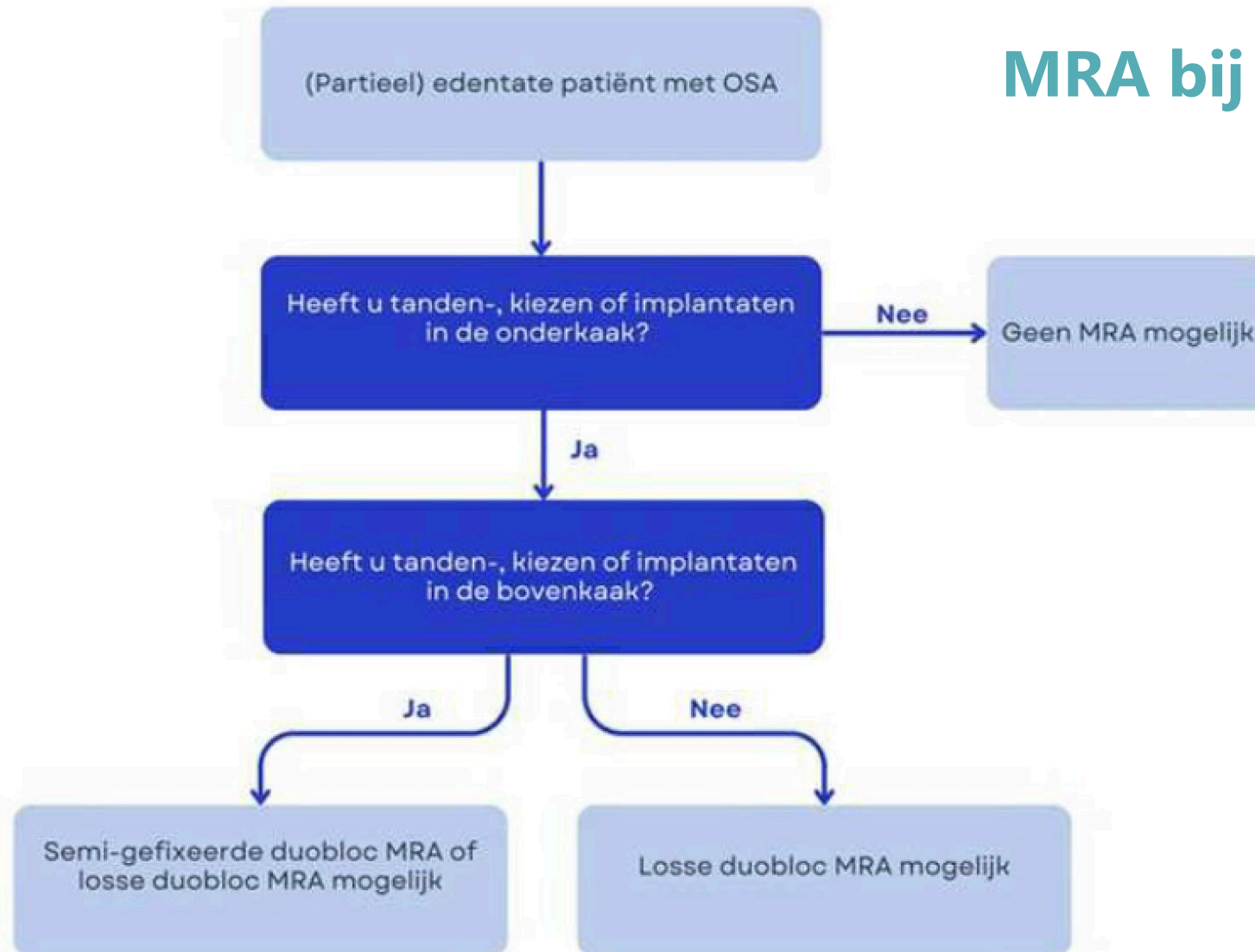
**E.C.M. Schotanus**

Meer informatie

**H.H.R. Al-Bayyati**

Meer informatie

MRA bij edentate patient?



Boil-and-Bite



medisch hulpmiddel

VIDEO

ONIRIS ★★★★★ 50 beoordelingen

Oniris anti snurkbeugel (MRA) op maat

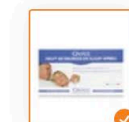
~~€75,95~~ **€68,35** Incl. btw

✓ Op voorraad

De Oniris snurkbeugel gebruik je om snurken en obstructieve slaapapneu te verhelpen of verminderen. Het apparaat plaatst de onderkaak voorzichtig naar voren om zo de luchtweg tijdens de slaap verder te openen. De beugel kan zelf op maat worden ingesteld. [Lees meer.](#)

[Bekijk de gebruiksaanwijzing](#)

Los of startset



Anti-snurkbeugel (MRA)



Anti-snurkbeugel (MRA) startset voordeelbundel

1



IN WINKELWAGEN



Voordelen Boil-and-Bite

Ideale selectietool

Gelijke werking op korte termijn

Handig hulpmiddel bij DISE

Niet goed, geld terug

Zelf aan te meten

Nadelen Boil-and-Bite

Minder draagcomfort

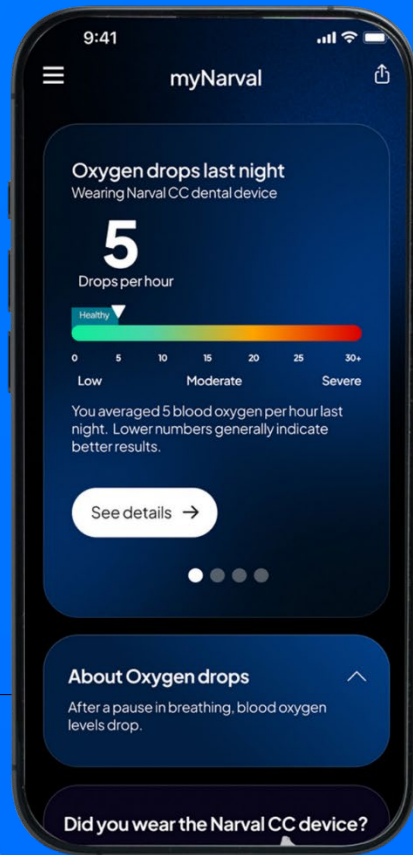
Risico op kaak- en gebitsklachten

Niet geschikt voor langere termijn

Nieuwe ontwikkeling

03

myNarval app



An app
designed to
support every
step of the
patient
treatment



The use of Oximeter O₂ ring is mandatory to capture sleep data in the app.

*All information is visible in the app **only by the patient**.*

For all new Narval patients an O₂ ring will be included in the shipping package with the Narval CC device (FR, NL and GE)

With myNarval patients can:

Visualize
their
progress

Visualize nocturnal O₂ drops

View SpO₂ data

Monitor Heart rate

View their time with
SpO₂ < 90%

Compare
nights

With and without
Narval CC

Visualize trends over time

Capture habits
with a Sleep
journal

Capture daily insights and
sleep habits

Track sleep quality over time

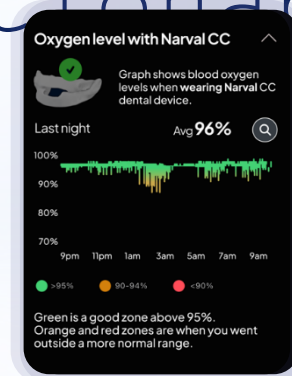
Monitor key lifestyle factors
(coffee, alcohol, stress)

Share pdf
report with
healthcare
professionals

Generate and download
a summary PDF report for
record keeping or easy sharing

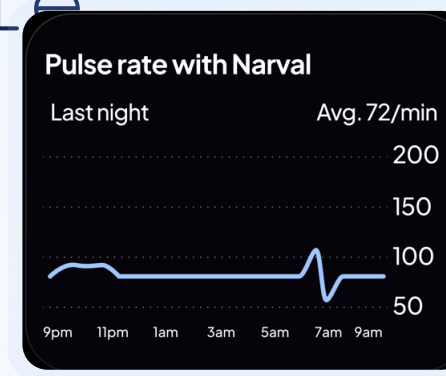
Patients can visualize progress

myNarval presents physiological markers in a clear, interpretable format with simple, actionable data



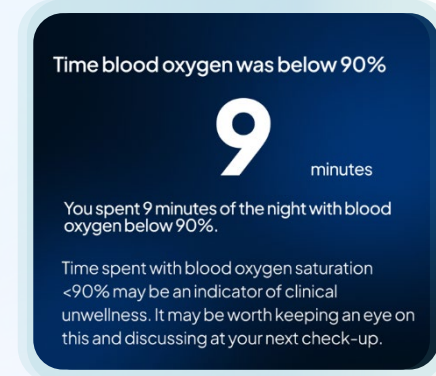
Overnight SpO₂ curve

Patients can access a detailed view of their overnight oxygen levels, showing how their saturation evolved throughout the night.



Nocturnal Pulse rate

Patients can review a detailed graph of their pulse rate during the night to visualize their heartbeat while sleeping.

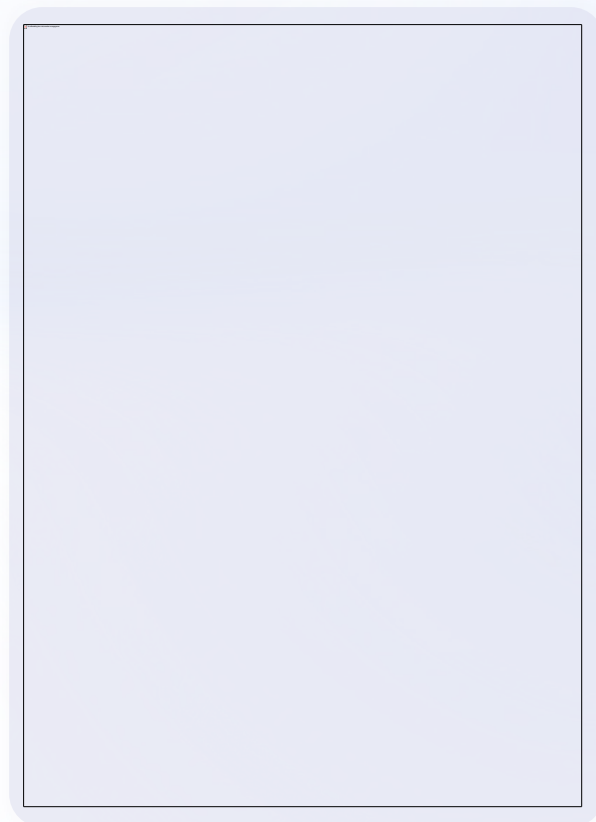
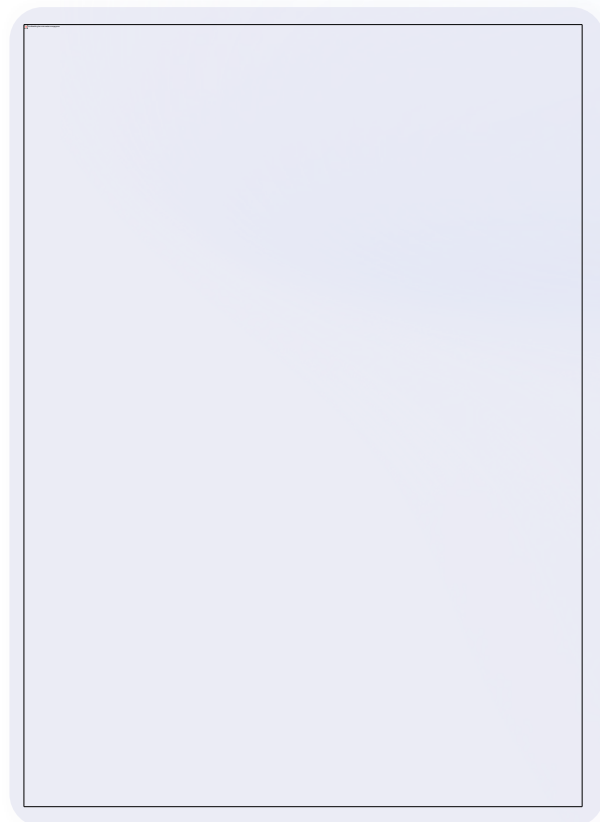


Time SpO₂ <90%

Patients can see exactly how much time their blood oxygen level stayed below 90%.

Patients can Share insights report with healthcare professionals

Patients can share with healthcare professionals a **30-day report summarizing** the sleep data displayed in myNarval app.



Last 30 days report

including

- Oxygen drops/h,
- Pulse rate
- SPO₂ split

Visibility of device usage
by the patient

And last night detailed report



A convenient way
to follow up with your
patients.



04

Practical cases

Sleep and Breathing (2020) 24:1229–1236
<https://doi.org/10.1007/s11325-020-02045-w>

DENTISTRY • ORIGINAL ARTICLE

A stepwise titration protocol for oral appliance therapy in positional obstructive sleep apnea patients: proof of concept

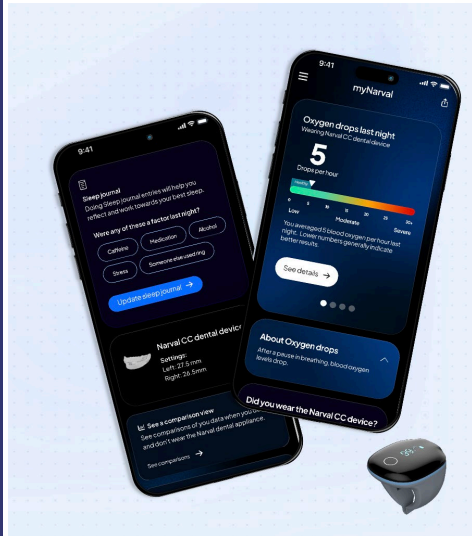
M. H. T. de Ruiter¹ • G. Aarab² • N. de Vries^{2,3,4} • F. Lobbezoo² • J. de Lange¹

Received: 24 November 2019 / Revised: 12 February 2020 / Accepted: 28 February 2020 / Published online: 11 March 2020
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Abstract



CONCLUSION



The Resmed Narval MAD is an effective oral appliance, strong and with perfect fit

The O2 ring creates a new era in the field of OAT for patients and physicians with OSA.

Including direct feedback on O2 stats, with the possibility to use a sleep journal and review your own MAD therapy.

Using the Sleep Report, the physician can monitor the treatment

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



ELSEVIER

Available online at www.sciencedirect.com



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[☆]

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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/smr



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



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 ($\pm$ SD)	Mean ($\pm$ SD)	Mean ($\pm$ SD)
VAS snoring pre-operative (0-10)	8.3 ($\pm$ 2.1)	8.4 ($\pm$ 1.8)	8.0 ($\pm$ 2.6)
VAS snoring post-operative (0-10)	2.0 ($\pm$ 2.1)	1.9 ($\pm$ 1.9)	2.0 ($\pm$ 2.4)
VAS aesthetics pre-operative (0-10)	5.8 ($\pm$ 2.2)	6.2 ($\pm$ 1.9)	5.1 ($\pm$ 2.7)
VAS aesthetics post-operative (0-10)	5.1 ($\pm$ 2.3)	5.7 ($\pm$ 2.1)	4.0 ($\pm$ 2.2)

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"*

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.



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Hartelijk dank voor uw aandacht!



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