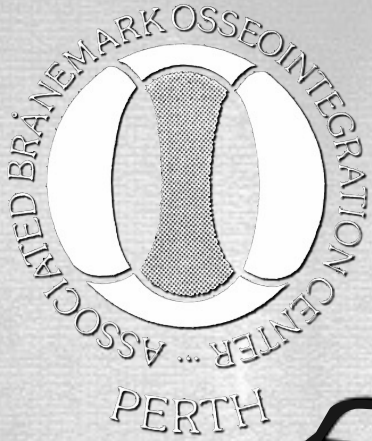




THE UNIVERSITY OF
WESTERN AUSTRALIA

Management of Edentulism and the Terminal Dentition -Overdentures

Clin A/Prof Glen Liddelow

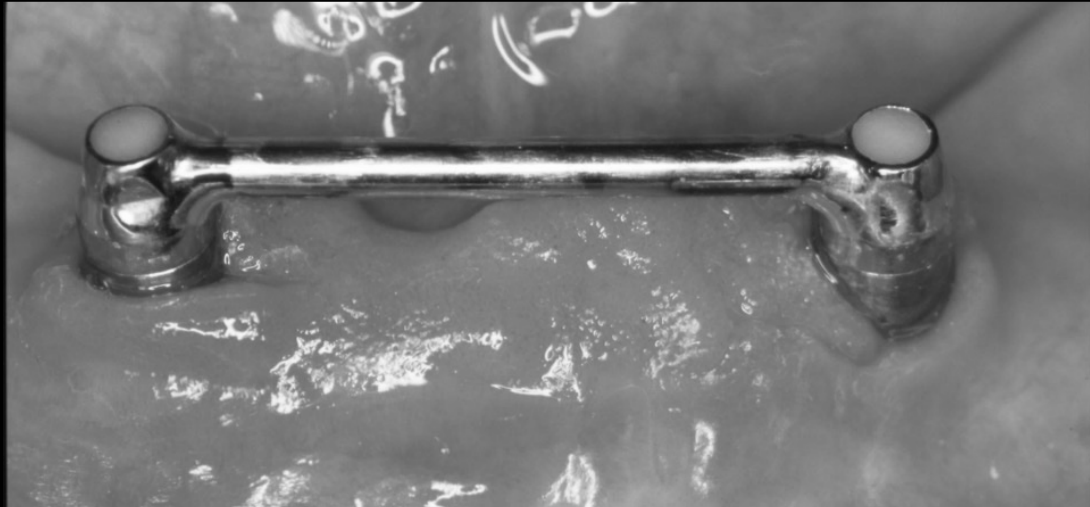
BDS_c(WA), MScD(WA), DClinDent(Syd), MRACDS(Pros), FPFA, FICD, FRACDS

B R Å N E M A R K C E N T R E P E R T H

Overdentures

Any removable dental prosthesis that covers and rests on one or more remaining natural teeth, the roots of natural teeth, and/or dental implants; a dental prosthesis that covers and is partially supported by natural teeth, natural tooth roots, and/or dental implants.

Two implant overdenture



McGill Consensus Statement on Overdentures

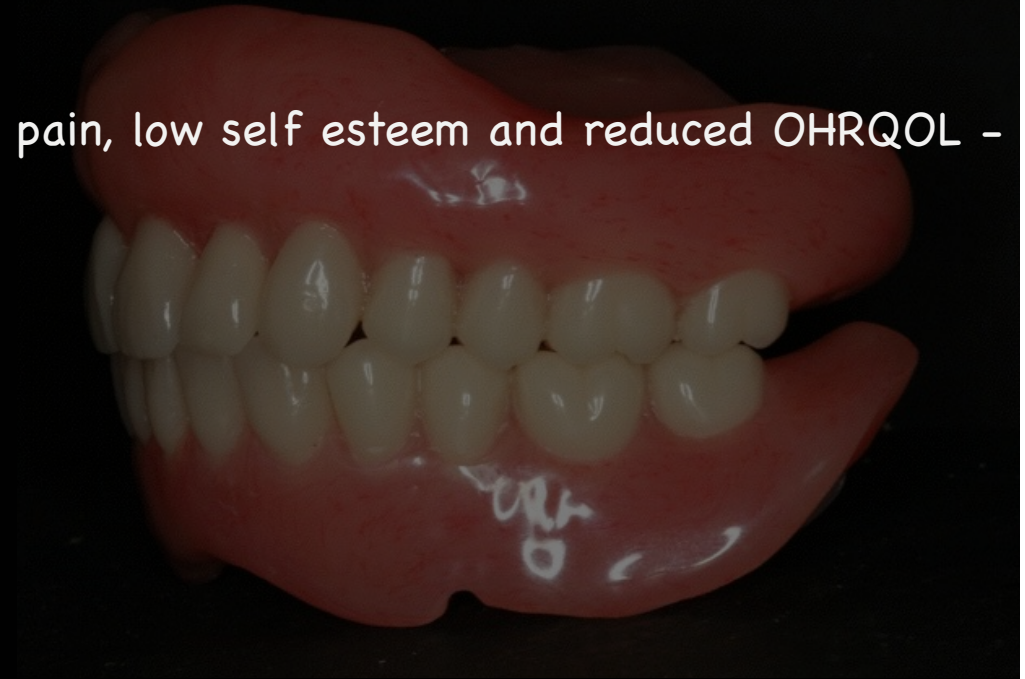
“There is now overwhelming evidence that a two implant overdenture should become the first choice of treatment for the edentulous mandible.”

The McGill consensus statement on overdentures. Mandibular two-implant overdentures as first choice standard of care for edentulous patients. Montreal, Quebec, May 24-25, 2002. Feine JS, Carlsson GE, Awad MA, Chehade A, Duncan WJ, Gizani S, Head T, Lund JP, MacEntee M, Mericske-Stern R, Mojon P, Morais J, Naert I, Payne AG, Penrod J, Stoker GT, Tawse-Smith A, Taylor TD, Thomason JM, Thomson WM, Wismeijer D. Int J Oral Maxillofac Implants. 2002 Jul-Aug; 17(4):601-2. Review.

Prosthodontic treatment

Most complete denture wearers adapt and cope

Some suffer substantially from chronic dysfunction, pain, low self esteem and reduced OHRQOL – maladaptive



Zarb GA. The edentulous predicament. In: Zarb GA, Bolender CL. Prosthodontic Treatment for Edentulous Patients. Mosby, Philadelphia, PA. 2004.

Prosthodontic treatment

Principles

Safest

Least invasive

Least costly

Least complex



Reasonable needs and expectations

Mechanical
stability

Biologic stability

Longevity

Low maintenance

Fitzpatrick B. Standard of care for the edentulous mandible: A systematic review. J Prosthet Dent 2006;95:71-78.

Overdentures

- Overdenture complications higher than fixed
 - ↑ peri-implant mucosal problems
 - ↑ Mechanical problems (attachments)
 - ↓ Phonetic problems

Bergendal T, Enquist B. Implant supported overdentures: A longitudinal prospective study. IJOMI 1998;13:253

Enquist B, Bergendal T, Kallus T. A retrospective multi-center evaluation of osseointegrated implants supporting overdentures. IJOMI 1998;3:129

Overdentures

- Sig more post placement adjustments and repairs than fixed
- 50% req adjustment or repair in first 3 years
- repeated repairs significant
- 72-98 mins for maintenance during the first year
- ↑ Mechanical problems with Mx OD cf Mn OD

Walton JN, MacEntee MI. A retrospective study on the maintenance and repair of implant-supported prostheses. *Int J Prosthodont.* 1993 Sep-Oct;6(5):451-5.

Watson GK, Payne AG, Purton DG, Thomson WM. Mandibular overdentures: professional time for prosthodontic maintenance during the first year of service using three different implant systems. *Int J Prosthodont.* 2002 Jul-Aug;15(4):379-84.

Watson RM, Jemt T, Chai J, Harnett J, Heath MR, Hutton JE, Johns RB, Lithner B, McKenna S, McNamara DC, Naert I, Taylor R. Prosthodontic treatment, patient response, and the need for maintenance of complete implant-supported overdentures: an appraisal of 5 years of prospective study. *Int J Prosthodont.* 1997 Jul-Aug;10(4):345-54.

Overdentures

- Ridge resorption
- High Mental F – nerve compression

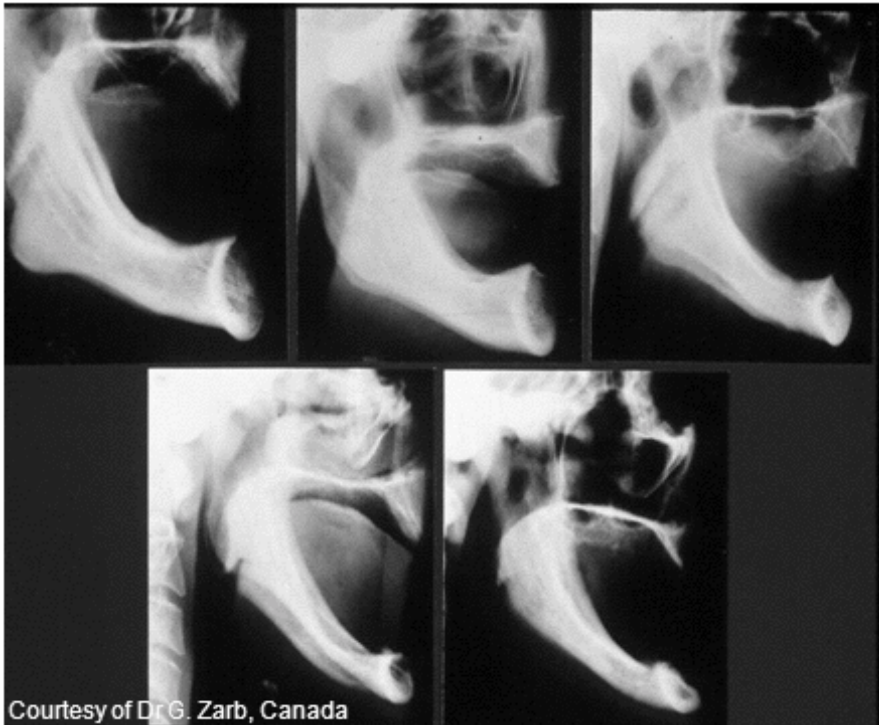
Ekfeldt A, Johansson LA, Isaksson S. Implant supported overdenture therapy: A retrospective study. Int J Pros 1997;10:366-374.

Watson R, Jemt T, Chai J, Harnett J et al. Prosthodontic treatment, patient response and the need for maintenance of complete implant supported overdentures ; an appraisal of 5 years of prospective study. Int J Pros 1997;10:345-354.

Naert I, Gizani S van Steenberghe D. Rigidly splinted implants in the resorbed maxilla to retain a hinging overdenture: a series of clinical reports for up to 4 years. J Pros Dent 1998;79:156-164.

Follow-up and basic maintenance requirements of the edentulous patient

Follow-up: Relining



Courtesy of Dr G. Zarb, Canada

Ridge resorption



Tallgren A. The continuing reduction of the residual alveolar ridges in complete denture wearers: A mixed-longitudinal study covering 25 years. J Prosthet Dent 1972;27:120-32

Attachments and Splinting



Historical background - Attachment Mechanisms

Splinted vs unsplinted

Finite element testing

Meijer HJA, Kuiper JH, Starman FJM, Bosman F. Stress distribution around dental implants: Influence of superstructure, length of implants, and height of mandible. JPD. 1992;68:96-102

Survival rates

Naert, Gizani, Vuylsteke, van Steenberghe. A 5yr randomised clinical trial on the influence of splinted and unsplinted oral implants in the mandibular overdenture therapy. ClinOralImplRes. 1998;9:170-177

Historical background - Attachment Mechanisms

Splinted vs unsplinted

Prosthetic complications

Gotfredsen K, Holm B. Implant – Supported Mandibular Overdentures Retained with Ball or Bar Attachments: A Randomized Prospective 5 – Year Study. Int J Prosthodont 2000;13:125-130

Naert I, Gizani S, Vuylsteke M, van Steenberghe D. A 5yr prospective randomised clinical trial on the influence of splinted and unsplinted oral implants in the mandibular overdenture therapy. Part II Prosthetic aspects and patient satisfaction. J Oral Rehab 1999;26:195-202

Andreiotelli M, Att W, Strub J. Prosthodontic complications with implant overdentures: A systematic literature review. Int J Pros 2010;23:195-203

Still no consensus, variable studies with little consistency



Inexpensive

Removable

Simple

Good stabilisation

*Applicable to existing
denture*

Large patient potential

Immediate loading studies

Chiapasco et al 2001 JOMI Brånemark System 10pts 40impl Within 3 days >2 years CSR 97.5% 4 bar

Chiapasco et al 2003 ClinImplDentRelRes Brånemark 82pts 328impl Day after surg 3 to 8 years CSR 96.1% 4 bar

Payne et al 2001 ClinImplDentRelRes Brånemark 10pts 20impl After 2 weeks 2 - 52 weeks CSR 100% 2 ball

Raghoobar et al 2003 ClinImplDentRelRes Brånemark 30pts 120impl Within 6 weeks 3 years CSR 93.0% 4 bar

Rungcharassaeng 2002 JPD HA, SteriOss 5pts 20impl After 1-2 weeks 1 year CSR 100% 4 bar

Tawse-Smith et al 2002 ClinImplDentRelRes SteriOss 24pts 48impl After 6 weeks 2 years CSR 95.8% 2 ball

Southern Implants 12pts 24impl After 6 weeks 2 years CSR 100% 2 ball

Ma S, Payne A. Marginal bone loss with mandibular two-implant overdentures using different loading protocols: a systematic literature review. Int J Pros 2010;23:117-26.

Alsabeeha N, Atieh M, Payne AG. Loading protocols for mandibular implant overdentures: a systematic review with meta-analysis. Clin Impl Dent Rel Res 2010;12:28-38.

Immediate loading

Alsabeeha N, Atieh M, Payne AG. Loading protocols for mandibular implant overdentures: A systematic review with meta-analysis. Clin Implant Dent Relat Res. 2010;12:28-38.

- 10 studies all short term

- No sig diff immediate vs early vs conventional

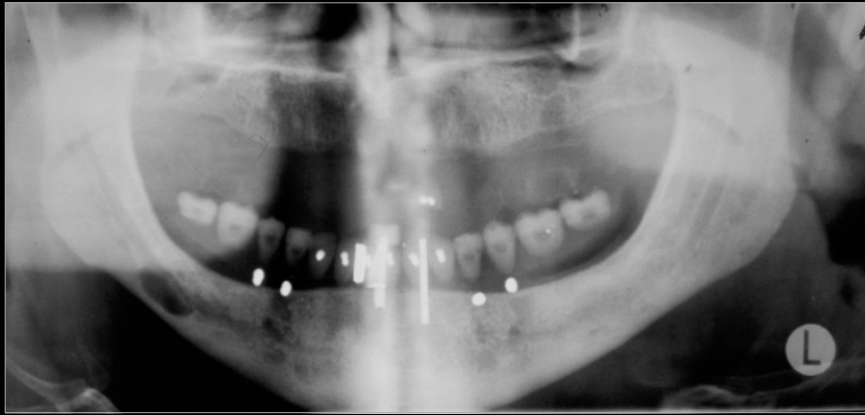
Ma S, Payne A. Marginal bone loss with mandibular two-implant overdentures using different loading protocols: A systematic literature review. Int J Pros 2010;23:117-126.

- 25 studies -early and immediate loading only short term

- Heterogeneity and differing measurement of bone levels starting at different times

- No detrimental effect on marginal bone levels

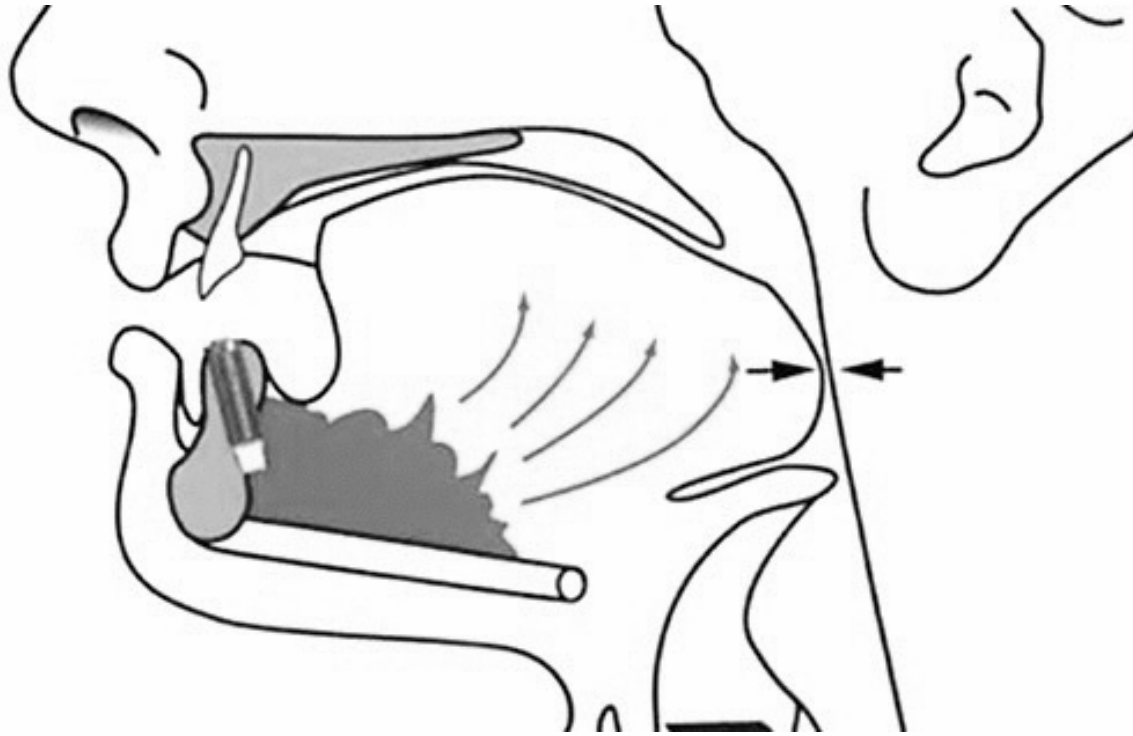
Life-threatening haemorrhage



Perforation of lingual plate of the anterior mandible damaging small branches of local arteries

(terminal branches of the submental artery or the mylohyoid artery)

Bleeding may not be immediately apparent



Slow progressive post-operative bleeding may result in distension of the soft tissues of the floor of the mouth, elevation of the tongue and compromise of the patient's airway

References

Mason ME, Triplett RG, Alfonso WF Life threatening hemorrhage from placement of a dental implant J Oral Maxillofac Surg 1990; 48(2):201-204

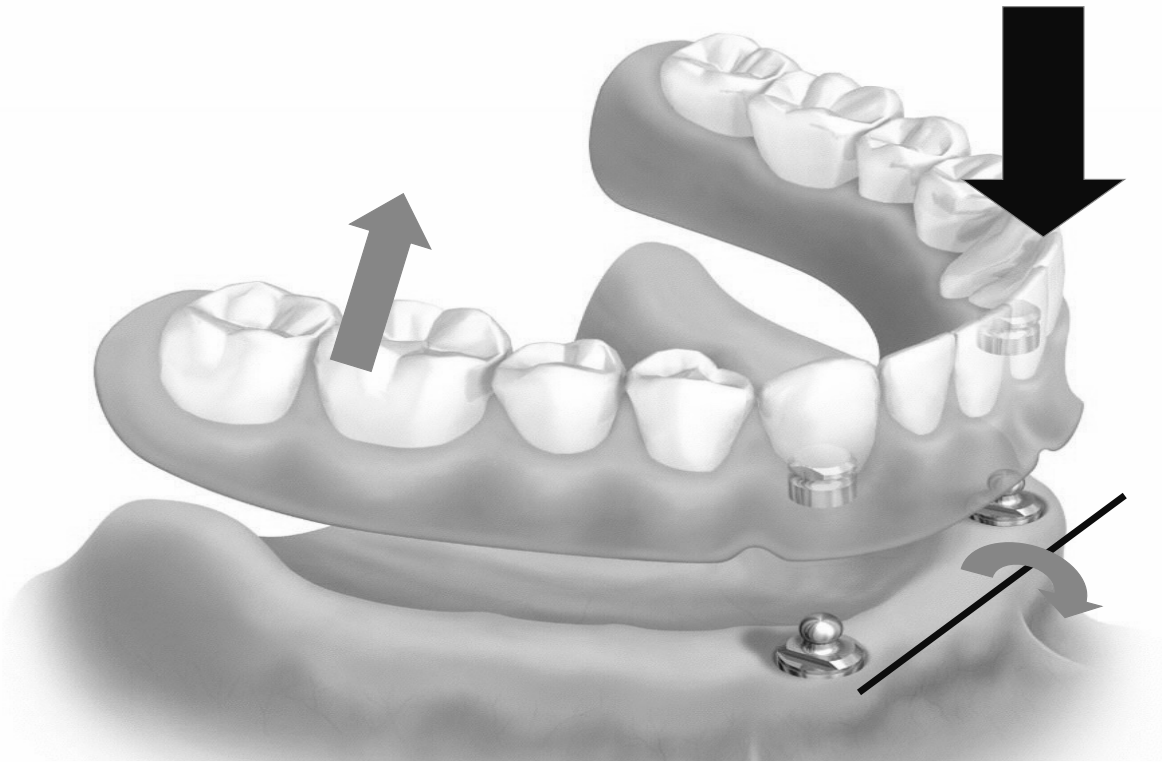
Laboda G Life threatening hemorrhage after placement of an endosseous implant JADA 1990; 121:599-600

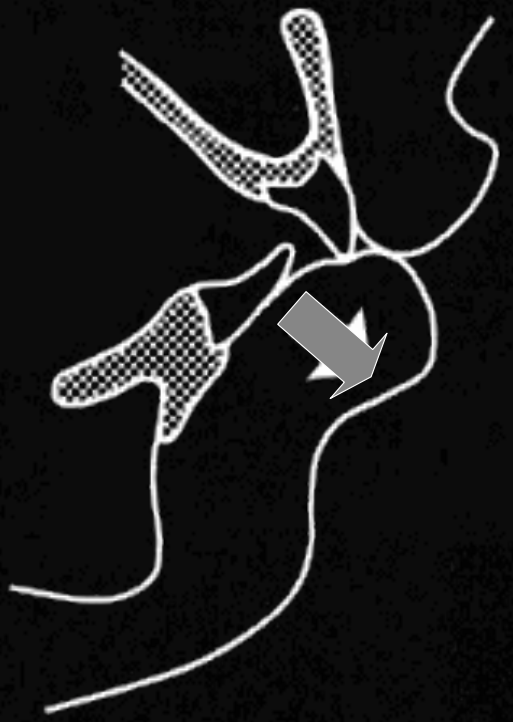
Ten Bruggenkate CM, Krekeler G, Kraaijenhagen HA, Foitzik C, Oosterbeek HS Hemorrhage of the floor of the mouth resulting from lingual perforation during implant placement Int J Oral Maxillofac Implants 1993; 8(3):329-334

Mordenfeld A, Andersson L, Bergstrom B. Haemorrhage in the floor of the mouth during implant placement in the edentulous mandible: A case report. Int J Oral Maxillofac Implants 1997;12:558-561.

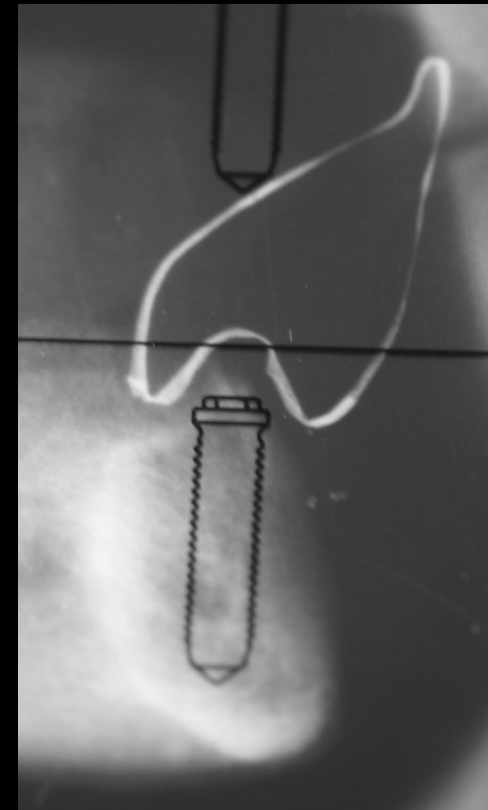
Kalpidis CD, Setayesh RM. Haemorrhaging associated with endosseous implant placement in the anterior mandible: A review of the literature. J Periodontol. 2004;75:63.

Position of the Implants?



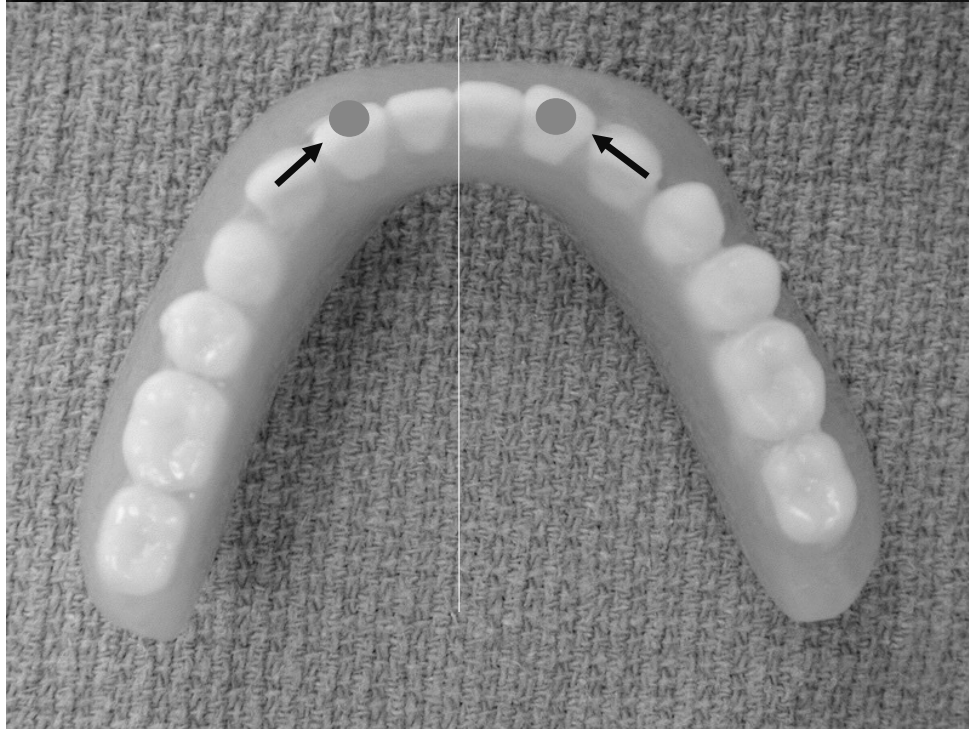


*Difficult
Situation: Angle
Class II*



*Lateral incisor
placement*





Placing the Implants in the Lateral Incisor region

- ↓ lifting during incising
- Antero-posterior stability
- ↓ attachment wear
- Allow for upgrading

Occlusion - overdenture

Tissue borne/ implant retained - extrapolated from denture studies

Occlusal concepts

Mastication, swallowing and parafunction

Masticatory ability studies

Many studies concentrate on masticatory efficiency

Not influenced by occlusal scheme

Satisfaction of the patient

Weak evidence for lingualised occlusion compared to 0° teeth or bilateral balanced articulation.

Peroz et al - canine guidance greater satisfaction to balanced articulation

Lang BR. J Prosthet Dent 1994;72:538-542

Kapur K, Soman S J Prosthet Dent 1965;15:662-670

Clough HE, Knodle JM, Leeper SH, Pudwill ML, Taylor DT. J Prosthet Dent. 1983 Aug;50(2):176-9.

Kimoto S et al Int J Prosthodont. 2006 19(1):103-9

Peroz I, Leuenberg A, Haustein I, Lange KP Quintessence Int. 2003 Sep;34(8):607-12

Occlusion - overdenture

Least complicated approach

Satisfy comfort, aesthetics and function

Functional and non-functional

Maximum intercuspation to coincide with CR at acceptable OVD

Occlusal scheme dependent on patient variables

Lingualised balanced occlusion

Klineberg I, Kingston D, Murray, G. Clin. Oral Impl. Res. 2007;18:151-167.

Lang BR. Dent Clin North Am. 2004 Jul;48(3):641-65

Hobkirk J (in) Klineberg I, Jagger R. 2004 Occlusion and clinical practice: An evidence-based approach. Wright, Oxford

Wennerberg A, Carlsson GE, Jemt T Int J Prosthodont. 2001;14(6):550-5.

Payne AG, Tawes-Smith A, Kumara R, Thomson WM. Clin Impl Dent & Related Res 2001;3:9-19.

Feine J, Carlsson G Implant overdentures: The standard of care for edentulous patients 2003 Quintessence, Ill

Single implant overdenture

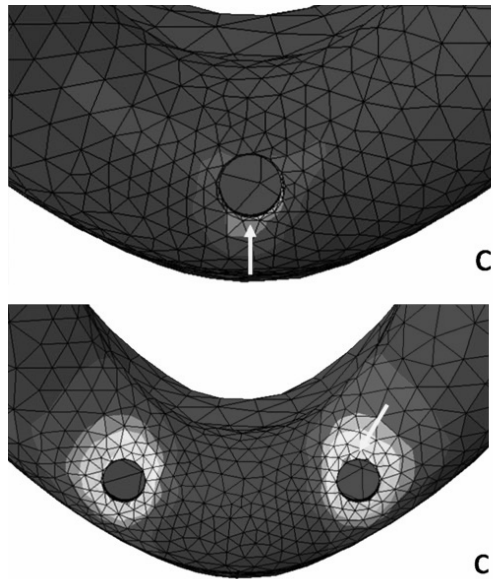
A 10 year review



Liddel GJ, Henry PJ. A prospective study of immediately loaded single implant-retained mandibular overdentures: Preliminary one-year results. *J Prosthet Dent* 2007;97:126-137.

Liddel GJ, Henry PJ. The immediately loaded single implant retained mandibular overdenture: A 36-month prospective study. *Int J Prosthodont* 2010;23:13-21.

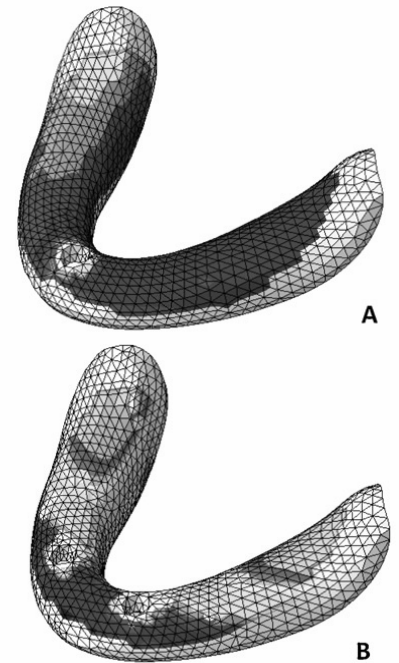
Single vs Two



Similar lateral forces to abutments and denture base movements under molar functional loads comparing SIOD and 2IOD

5X stress on abutments with 2IOD under incisal load compared with SIOD

Greater rotation around 2IOD and loss of mucosal contact with incisal load



Maeda Y, Horisaka M, Kaztomo Y. Biomechanical rationale for a single implant-retained mandibular overdenture: An in vitro study. Clin Oral Impl Res 2008;19:271-275.
Liu J, Pan S, Dong J, Mo Z, Fan Y, Feng H. Influence of implant number on the biomechanical behaviour of mandibular implant-retained/supported overdentures: a three-dimensional finite element analysis. J Dent. 2013;41:241-9.

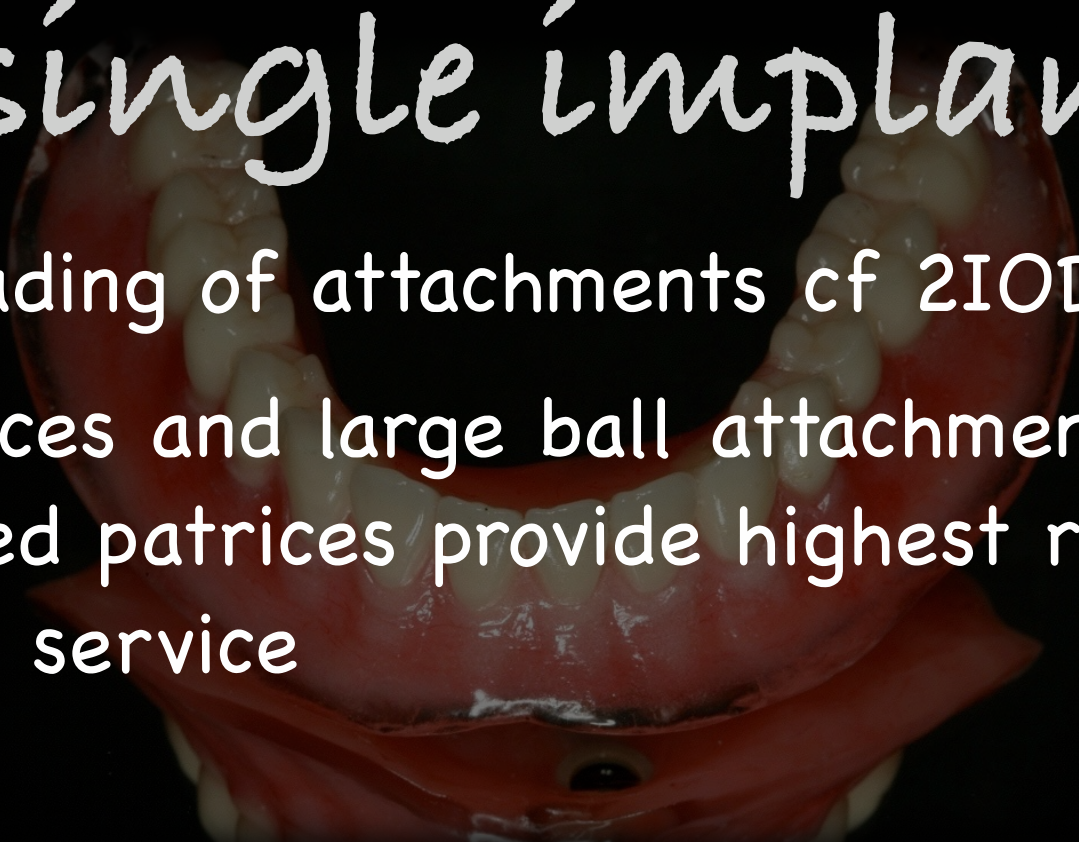
The single implant

Similar lateral forces to abutments
and denture base movements
under molar functional loads
comparing SIOD and 2IOD



Maeda Y, Horisaka M, Kaztomo Y. Biomechanical rationale for a single implant-retained mandibular overdenture: An in vitro study. Clin Oral Impl Res 2008;19:271-275.

The single implant



No off-axis loading of attachments cf 2IOD

Resilient matrices and large ball attachments systems of TiN coated matrices provide highest retention and longest service

Alsabeeha N, Swain M, Payne A. Clinical performance and material properties of single-implant overdenture attachment systems. Int J Prosthodont 2011;24:247-254.

Alsabeeha N, Atieh M, Swain M, Payne A. Attachment systems for mandibular single-implant overdentures: An in-vitro retention force investigation on different designs. Int J Prosthodont 2010;23:160-166.

The single implant

1 year results of 36 patients

6 week delayed loading

Southern regular – 75% Standard Ball (2.25 and Gold matrix)

Southern Wide – 100% Large ball (5.9 and Plastic matrix)

Neoss Regular – 100% Locator (4mm and nylon insert)

*Sig greater maintenance with standard ball and Locator

Large ball and plastic matrix recommended

Alsabeeha N, Payne A, De Silva R, Thomson W. Mandibular single implant overdentures: Preliminary results of a randomised-control trial on early loading with different implant diameters and attachment systems. Clin Oral Impl Res 2011;22:330-337.

Alsabeeha NH, Swain MV, Payne AG. Clinical performance and material properties of single-implant overdenture attachment systems. Int J Prosthodont. 2011;24:247-54.

One or two?

85 subjects reviewed at one year

Randomised pretreat to SIOD or 2IOD

Single stage, standard ball and reline at 6 weeks

5 implant failures prior to loading - all 2IOD

VAS score improvement of ~44 for both groups

median VAS SIOD 93, 2IOD 94 at one year - no sig difference in satisfaction

Component cost SIOD \$957, 2IOD \$1679

Pros maintenance time similar

SIOD - ↓ component costs, ↓ surgery, ↓ post surg maintenance, ↓ reline time

Walton J, Glick N, Macentee M. A randomized clinical trial comparing patient satisfaction and prosthetic outcomes with mandibular overdentures retained by one or two implants. Int J Prosthodont 2009;22:331-339.

One or two?

36 subjects reviewed at one year

Randomised pretreat to SIOD or 2IOD

Single stage, TiUnite Branemark 2.25 ball and relined day of surgery

implant survival rate 81.8% – no difference for 1 or 2

No requirement for high implant stability – 8/10 failures had initial insert torque of 30 Ncm although all had ISQ 69–79.

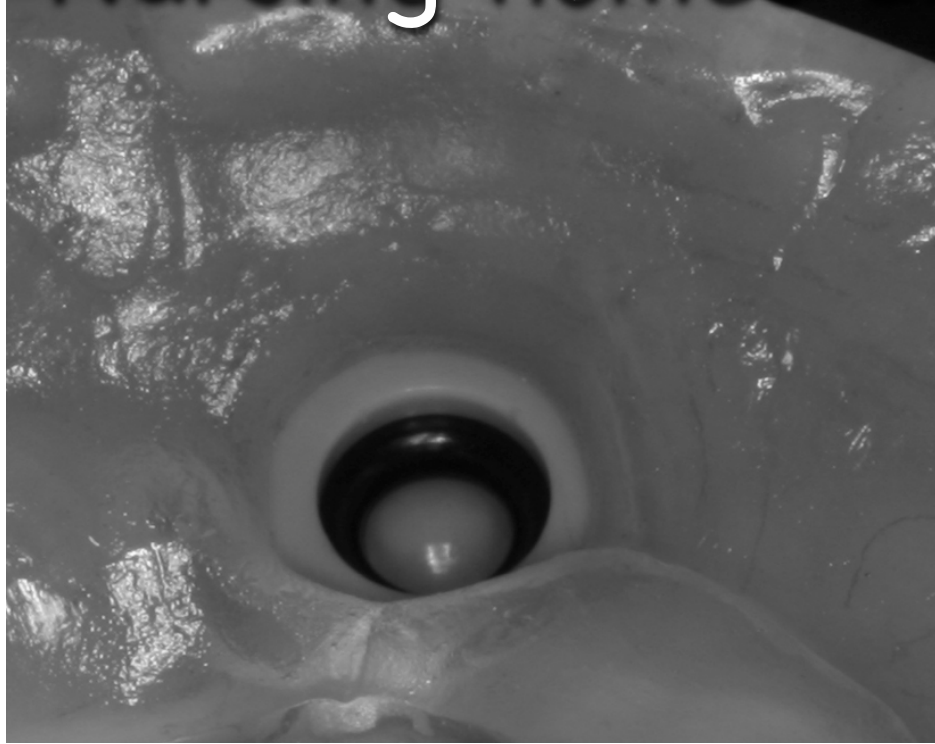
28 replacements of O-rings

Kronstrom M, Davis B, Loney R, Gerrow J, Hollender L. A prospective randomised study on the immediate loading of mandibular overdentures supported by one or two implants: A 12 month follow-up report. *IJOMI* 2010;25:181–188.
Atieh MA, Alsabeeha NH, Payne AG. Can resonance frequency analysis predict failure risk of immediately loaded implants? *Int J Prosthodont*. 2012;25:326–39.

Current and future directions

Manual skill and visual acuity

Nursing homes and oral hygiene



91yo F
Dementia
10yr SIOD
1 reline



Treatment strategies for the edentulous maxilla

Maxillary complete denture is not satisfactory

– Implant overdenture IOD

- Concept of a denture is agreeable
- Additional facial support and retention is indicated
- Phonetic issues
- Long term previous palatal coverage

Implant detachable prosthesis

Implant Supported

palate not covered

Facilitates plaque control

May facilitate
maintenance

May facilitate technical
procedures

Often a fallback
strategy where facial
support with a
denture flange is
indicated

Maxillary Overdentures

- Survival rate of implants greater supporting FDP than RDP
- Mean failure rate 19%

Bergendal T, Enquist B. Implant supported overdentures: A longitudinal prospective study. IJOMI 1998; 13:253

Enquist B, Bergendal T, Kallus T. A retrospective multi-center evaluation of osseointegrated implants supporting overdentures. IJOMI 1998; 3:129

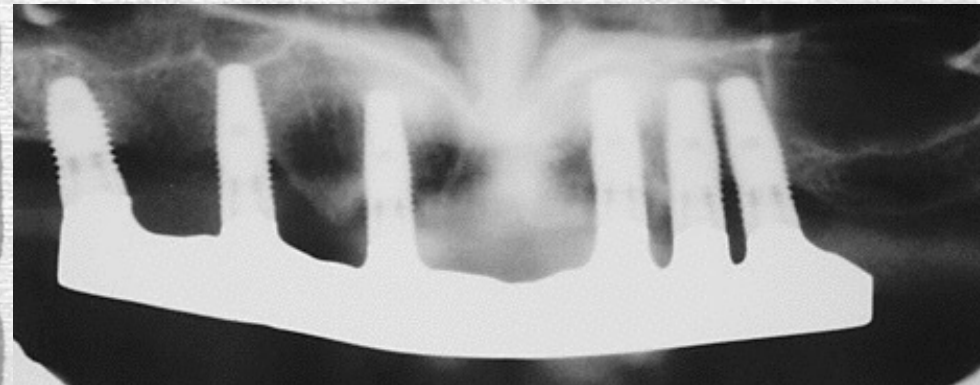
Jemt T. Fixed implant supported prostheses in the edentulous maxilla: A five year follow-up report. Clin Oral Impl Res 1994; 5:142

Sadowsky S. Treatment considerations for maxillary implant overdentures: A systematic review. J Prosthet Dent 2007; 97:340-348

Maxillary Overdentures

Overdenture complications higher than fixed

- ↑ peri-implant problems
- ↑ Mechanical problems (attachments)
- ↓ Phonetic problems



Bergendal T, Enquist B. Implant supported overdentures: A longitudinal prospective study. IJOMI 1998; 13:253

Enquist B, Bergendal T, Kallus T. A retrospective multi-center evaluation of osseointegrated implants supporting overdentures. IJOMI 1998; 3:129

Jemt T. Failures and complications in 92 consecutively inserted overdentures supported by Brånemark implants in severely resorbed edentulous maxillae: a study from prosthetic treatment to first annual check-up. Fixed implant supported prostheses in the edentulous maxilla: A five year follow-up report. IJOMI 1992; 7:162-167.

Maxillary Overdentures

- Sig more post placement adjustments and repairs than fixed
- 50% req adjustment or repair in first 3 years
- repeated repairs significant
- 72-98 mins for maintenance during the first year
- ↑ Mechanical problems with Mx OD cf Mn OD

Walton JN, MacEntee MI. A retrospective study on the maintenance and repair of implant-supported prostheses. *Int J Prosthodont.* 1993 Sep-Oct;6(5):451-5.

Watson GK, Payne AG, Purton DG, Thomson WM. Mandibular overdentures: professional time for prosthodontic maintenance during the first year of service using three different implant systems. *Int J Prosthodont.* 2002 Jul-Aug;15(4):379-84.

Watson RM, Jemt T, Chai J, Harnett J, Heath MR, Hutton JE, Johns RB, Lithner B, McKenna S, McNamara DC, Naert I, Taylor R. Prosthodontic treatment, patient response, and the need for maintenance of complete implant-supported overdentures: an appraisal of 5 years of prospective study. *Int J Prosthodont.* 1997 Jul-Aug;10(4):345-54.

Maxillary Overdentures

- Established criteria for IOD design lacking
- Minimum of 4 implants well spaced
- 2-3X greater risk of failure with each increment of bone quality

Bergendal T, Enquist B. Implant supported overdentures: A longitudinal prospective study. IJOMI 1998; 13:253

Enquist B, Bergendal T, Kallus T. A retrospective multi-center evaluation of osseointegrated implants supporting overdentures. IJOMI 1998;3:129

Jemt T. Failures and complications in 92 consecutively inserted overdentures supported by Brånemark implants in severely resorbed edentulous maxillae:

A study from prosthetic treatment to first annual check-up. Fixed implant supported prostheses in the edentulous maxilla: A five year follow-up report. IJOMI 1992;7:162-167.

Sadowsky S. Treatment considerations for maxillary implant overdentures: A systematic review. J Prosthet Dent 2007;97:340-348

Maxillary Overdentures

Connection of Implants

- Greater bone loss around non-splinted implants - (small studies)
- Increased bone loss with OD anyway but often clustered

Quirynen M, Naert I, van Steenberghe D, Teerlinck J, Dekeyser C, Theuniers G. Periodontal aspects of osseointegrated fixtures supporting an overdenture. A 4-year retrospective study. J Clin Periodontol. 1991;18(10):719-28.

Naert I, Quirynen M, Theuniers G, van Steenberghe D. Prosthetic aspects of osseointegrated fixtures supporting overdentures. A 4-year report. J Prosthet Dent. 1991;65(5):671-80.

Närhi TO, Hevinga M, Voorsmit RA, Kalk W. Maxillary overdentures retained by splinted and unsplinted implants: a retrospective study. Int J Oral Maxillofac Implants. 2001;16(2):259-66

Mericske-Stern R, Oetterli M, Kiener P, Mericske E. A follow-up study of maxillary implants supporting an overdenture: clinical and radiographic results. Int J Oral Maxillofac Implants. 2002;17(5):678-86.

Sadowsky S. Treatment considerations for maxillary implant overdentures: A systematic review. J Prosthet Dent 2007;97:340-348

Stoumpis C, Kohal J. To splint or not to splint oral implants in implant supported overdenture therapy? A systematic review. J Oral Rehab 2011;38:857-869

Maxillary Overdentures

- Mx OD should be supported by at least 4 implants evenly distributed and connected by a bar
- 1-2mm space between bar and mucosa
- Height as small as possible for comfort and strength of prosthesis

Mericske-Stern R. Treatment outcomes with implant-supported overdentures: clinical considerations. J Prosthet Dent. 1998;79(1):66-73. Review.

Mericske-Stern R. Prosthodontic management of maxillary and mandibular overdentures. In Feine J Carlsson G (eds) Implant overdentures. The standard of care for edentulous patients. Quintessence. 2003

Hemmings KW, Welfare RD. A technique for the replacement of implant-retained overdentures. J Prosthet Dent. 1994 Aug;72(2):219-21

Sadowsky S. Treatment considerations for maxillary implant overdentures: A systematic review. J Prosthet Dent 2007;97:340-348

Andreiotelli M, Att W, Strub J. Prosthodontic complications with implant overdentures: A systematic review. Int J Pros 2010;23:195-203.

Maxillary Overdentures

- Mucosal enlargement common - up to 64%
- Denture stomatitis 31%
 - Negative pressure gradient
 - Acidogenic environment

Ekfeldt A, Johansson LA, Isaksson S. Implant supported overdenture therapy: A retrospective study. Int J Pros 1997;10:366-374.

Watson R, Jemt T, Chai J, Harnett J et al. Prosthodontic treatment, patient response and the need for maintenance of complete implant supported overdentures ; an appraisal of 5 years of prospective study. Int J Pros 1997;10:345-354.

Naert I, Gizani S van Steenberghe D. Rigidly splinted implants in the resorbed maxilla to retain a hinging overdenture: a series of clinical reports for up to 4 years. J Pros Dent 1998;79:156-164.

Treatment Strategies for the Edentulous Maxilla

- 50% ridge width lost in 1st year
- Mean thickness inferior to floor of sinus $6.1 \pm 2.8\text{mm}$
- ↓ Bone quality in post Mx ↓ implant survival rate

Schropp L, Wenzel A, Kostopoulos L. Bone healing and soft tissue contour changes following tooth extraction. I J Perio Rest Dent 2003;23:313.

Razavi R, Zena R, Khan Z. Anatomic site evaluation of the edentulous maxilla for dental implant placement. J Pros 1995;4:90.

Tolstunov L. Implant zones of the jaws: Implant location and related success rate. J Oral Implantol 2007;33:211.

The Edentulous Predicament

Optimised management



Acceptable management

State of the art



Public health

Aesthetic demand



Consequences of tooth loss