Overdentures

Maxilla

1. **AK** Di Francesco F, et al. Patient satisfaction and survival of maxillary overdentures supported by four or six splinted implants: a systematic review with meta-analysis. BMC Oral Health. 2021 May 8;21(1):247. doi: 10.1186/s12903-021-01572-6.
2. **TV** Kappel S, Klotz AL, Eberhard L, Lorenzo Bermejo J, Rammelsberg P, Giannakopoulos NN. Maxillary implant overdentures on two or four implants. A prospective randomized cross-over clinical trial of implant and denture success and survival. Clin Oral Implants Res. 2021 Sep;32(9):1061-1071. doi: 10.1111/clr.13800.
3. **DL** Sadowsky SJ, Zitzmann NU. Protocols for the Maxillary Implant Overdenture: A Systematic Review. Int J Oral Maxillofac Implants. 2016;31 Suppl:s182-91. doi: 10.11607/jomi.16suppl.g5.2.
4. **CM** Andreiotelli M, Att W, Strub JR. Prosthodontic complications with implant overdentures: a systematic literature review. Int J Prosthodont. 2010 May-Jun;23(3):195-203.

Mandible

5. **VX** Alsabeeha N, Payne AG, De Silva RK, Swain MV. Mandibular single-implant overdentures: a review with surgical and prosthodontic perspectives of a novel approach. Clin Oral Implants Res. 2009 Apr;20(4):356-65. doi: 10.1111/j.1600-0501.2008.01666.x.
6. **RH** Rashid F, Awad MA, Thomason JM, Piovano A, Spielberg GP, Scilingo E, Mojon P, Müller F, Spielberg M, Heydecke G, Stoker G, Wismeijer D, Allen F, Feine JS. The effectiveness of 2-implant overdentures - a pragmatic international multicentre study. J Oral Rehabil. 2011 Mar;38(3):176-84. doi: 10.1111/j.1365-2842.2010.02143.x.
7. **NL** Schwartz-Arad D, Kidron N, Dolev E. A long-term study of implants supporting overdentures as a model for implant success. J Periodontol. 2005 Sep;76(9):1431-5. doi: 10.1902/jop.2005.76.9.1431.
8. **MS** van der Bilt A, Burgers M, van Kampen FM, Cune MS. Mandibular implant-supported overdentures and oral function. Clin Oral Implants Res. 2010 Nov;21(11):1209-13. doi: 10.1111/j.1600-0501.2010.01915.x.
9. **AK** Emami E, Heydecke G, Rompré PH, de Grandmont P, Feine JS. Impact of implant support for mandibular dentures on satisfaction, oral and general health-related quality of life: a meta-analysis of randomized-controlled trials. Clin Oral Implants Res. 2009 Jun;20(6):533-44. doi: 10.1111/j.1600-0501.2008.01693.x.
10. **TV** Mericske-Stern RD, Taylor TD, Belser U. Management of the edentulous patient. Clin Oral Implants Res. 2000;11 Suppl 1:108-25. doi: 10.1034/j.1600-0501.2000.011s1108.x.
11. **DL** Abt E, Carr AB, Worthington HV. Interventions for replacing missing teeth: partially absent dentition. Cochrane Database Syst Rev. 2012 Feb 15;(2):CD003814. doi: 10.1002/14651858.CD003814.pub2.
12. **CM** Mijiritsky E. Implants in conjunction with removable partial dentures: a literature review. Implant Dent. 2007 Jun;16(2):146-54. doi: 10.1097/ID.0b013e3180500b2c.

Maxilla

Topic: maxillary overdentures
Authors: Di Francesco F, et al.
Title: Patient satisfaction and survival of maxillary overdentures supported by four or six splinted implants: a systematic review with meta-analysis
Source: BMC Oral Health. 2021 May 8;21(1):247. doi: 10.1186/s12903-021-01572-6.
DOI: 10.1186/s12903-021-01572-6

Reviewer: Amber Kreko
Type: systematic review
Keywords: maxillary overdentures, survival rates, splinted implants

Purpose: to compare maxillary overdentures supported by four or six splinted implants in terms of patient satisfaction, implant survival, overdenture survival, and prosthodontic complications

Material and methods:
- Systematic review for papers between January 2000 and December 2019.
- Pico research question: In fully edentulous patients requiring a maxillary implant supported overdenture, is there a difference between using four splinted or six splinted implants in terms of patient satisfaction, implant and overdenture survival, and prosthodontic complications?

Results:
- 15 articles were included
- 8 studies examined patient satisfaction and all showed high scores irrespective of the use of four or six splinted implants
- Survival rate of implants appeared to be very similar, with no significant difference between 4 and 6 implants.
- Overdenture survival showed no statistical difference between groups.
- Most frequent complicat was clip loosening or fracture, no difference between groups.

Conclusions: Bar supported overdenture on 4 implants is not inferior to bar supported on 6 implants in terms of patient satisfaction, implants or overdentures survival rates, and prosthodontic complications.

Topic: Maxillary Overdenture
Authors: Kappel, S et al
Title: Maxillary implant overdentures on two or four implants. A prospective randomized cross-over clinical trial of implant and denture success and survival
Source: Clin Oral Implants Res. 2021 Sep;32(9):1061-1071
DOI: 10.1111/clr.13800
Reviewer: Tam Vu
Type: Clinical
Keywords: dental implants, implant-supported, overdenture, loading, locator

Purpose:

1. To determine implant success and survival rate with 4 conventional but asynchronous loading for Mx OVD opposing Mn two-implant OVD
2. Assess pt preference of number and position of implants

Material and methods:

- 24 pts with mandibular OVD
- Guided surgery – each pt received 4 standard plus SLA implants (Straumann)
- Prosthetic procedure:
    - After 6-9 mo of healing
    - Each pt randomly allocated:

        - Uncovery of 2 canine implants
        - Uncovery of 2 molar implants
    - Allocated implants uncovered, and other 2 placed with healing caps
    - Denture loaded with 2 implants for 3 months
    - After 3 mo, other 2 implants were loaded and first 2 implants were replaced with healing caps
    - After 3 more mo, all 4 implants loaded for 3 mo
- Follow up exam at 12 months and then once a year
- Pts were asked if they prefer 2 canine or 2 molar implants and if they prefer 2 or 4 implants

Results:

- Implant survival after loading: 93.8% at avg 3.1 years
- Implant success rate: 90.6%
- Denture survival rate: 100%'
- Prosthetic complication
    - Major: framework facture (2)
    - Minor:
        - Changing of clips (8)
        - Abutment loss and refixing (4)
        - Microcrack in denture (6)
        - Resin repair after implant loss (5)
        - Relining of denture (2)
- 21 pts completed study w/out any implant loss
    - 2 anterior vs 2 posterior implants:
        - 9 preferred anterior implants
        - 3 preferred posterior
        - 9 no preference
- 2 vs 4 implants
    - 23 of 24 pts preferred 4 implants

Discussion

- This study has frequent implant loss, and also included smokers and diabetic pts
- 27 Mx OVD complications occurred among 11 pts; 78% of complications occurred among 5 pts
    - Need to determine risk indicators
- This study found more denture complication in Mn OVD
    - Most common: change or activate clips → due to increase load of Mx OVD
- Implant location preference may be due to position of mandibular implants
    - Those with no preference may reflect high adaptive capacity of masticatory system

Conclusion: implant survival and success rate are lower in the Mx compared to Mn. Two implants in the posterior are not superior to two anterior implants for OVD. Almost all pts prefer 4 implants vs 2.

Topic: Maxillary overdenture
Authors: Sadowsky SJ, Zitzmann NU.

Title: Protocols for the Maxillary Implant Overdenture: A Systematic Review.
Source: Int J Oral Maxillofac Implants. 2016;31 Suppl:s182-91.
DOI: 10.11607/jomi.16suppl.g5.2
Reviewer: Daeoo Lee
Type: Systematic Review
Keywords: overdenture, implant, maxillary
Purpose: To evaluate patient based outcomes after maxillary Implant Over denture (IOD)

Material and methods:

- Electronic search and hand search included (-August 2014)
- Limitations
    - Questionnaires based
        - Language/cultural differences
        - Answers may be guarded or misinterpreted
    - Inadequate adaptation period of prosthesis
    - Cross-sectional analysis
        - No comparison of before and after

Results:

- 20 studies included in analysis (530 pts between 1993-2014)
- Most used 4-6 implants
- Using turned/machined surface demonstrated reduced implant survival.
- “Shorter” implants of less than 10mm demonstrated lower implant survival rates.
    - However, this is linked to the short implant being machined implants.
- Number of implants
    - 3 implants short term survival was les than 86% (moderately rough)
    - 6 implants better than 2
    - More than 4 implants may be appropriate for pts with reduced bone, opposing natural dentition, and parafunction
    - No evidence but bar design may facilitate for better survival rate.
        - Care must be taken to enable cleaning underneath to avoid inflammation.
- Patient preference
    - Reduced palatal coverage in the area of esthetics and taste reflected in the OHIP
    - Zitzmann and Marinello: 80% wished to receive the fixed restoration
        - Among those initially requesting a fixed restoration, 38% were inclined to accept a max IOD after their specific local factors were reviewed.

Conclusions:

- Outcomes
    - A max IOD offers a stabilized removable solution for the edentulous maxilla that provides increased patient satisfaction and oral health QoL.
    - A higher failure rate is experienced with machined implants.
    - Four to six implants are widely applied in successful cohort studies.
    - When four or less implants are used for max IODs, unsplinted designs have a higher implant/prosthetic failure rate than splinted implants.
    - In general, both splinted and solitary anchorage systems are advocated. Maintenance may be higher for solitary attachments. Increased soft tissue inflammation has been reported under bars.

    - Palateless design offers better patient satisfaction.
- Guidelines
    - When considering a max IOD design, the practitioners' team and the patient must understand the importance of long-term regular maintenance care.
    - In the diagnostic phase, clinicians must identify systemic, local (eg, vertical space requirements) and patient-based factors to best select the adequate treatment regimen.
    - The max IOD prosthesis should be designed to be maintainable, retrievable, repairable, or replaceable.
    - Placing a minimum of four implants with a wide anteroposterior distribution of optimal support is recommended. Consider more implants when associated risk factors are present. Implants less than 10 mm in length challenge initial stability but implants with moderately rough surfaces may provide similar success rates irrespective of implant length.

Topic: Implant-supported OVD complications
Authors: Andreiotelli M., Att W., Strub JR.
Title: Prosthodontic Complications with Implant Overdentures: A Systematic Literature Review
Source: Int J Prosthodont 2010;23: 195-203.
DOI: Not found
Reviewer: Cyrus J Mansouri
Type: Systematic review
Keywords: dental implants – overdenture – complications

Background: Implant-assisted OVD = entirely supported by dental implants; Implant-retained OVD = support from implants and intraoral tissues.

Purpose:
To provide information on types of prosthodontic complications associated with implant-retained/supported OVDs. Biologic complications were outside the scope of this article.

Material and methods:
A literature search was completed for articles between 1980-2008 using MeSH terms for clinical studies, prospective cohort, and randomized clinical trials reporting complications related to implant-supported/retained OVDs.

Results:
A total of 18 studies were included (4 RCTs, 14 prospective clinical trials, with follow-up ≥ 5 years).

<u>Implant survival/success and type of attachment</u>
Maxillary OVDs generally involved an implant-splinted bar on 4-6 implants with a reported success rate between 72.4-84%. Cumulative survival rate for all maxillary and mandibular implant was 96% with a cumulative success rate of 93%. Another study reported a 5-year cumulative survival rate of 76.6%.

For mand OVDS, most studies employed bars, magnets, or bars as attachment systems. Number of implants were most consistently two but ranged for 1-4+. Implant survival ranged from 93-100% and did not appear to vary by splinting, rotational characterizes, or number of implants. One study showed pooled survival in the mandible as 95.4% at 10 years.

A significantly higher survival rate was demonstrated in the mandible vs maxilla. This could be related to short implants, poor bone quality/quantity, and a smaller number of implants in the pooled population. Newer implant surfaces could demonstrate higher integration rates in the maxilla.

Prosthetic success and incidence of technical complications

Prosthetic survival/success rates varied widely. Prosthetic maintenance was inconsistent between studies and variable definitions of events, visits, and occasions were used. One systematic review reports 4-10x higher prosthetic complication incidence with implant-supports/retained OVDS compared to fixed implant prostheses. Another study combined raw data from several studies report the following technical complication rates:

- OVD loss of retention or adjustment (30%)
- OVD rebasing or relining (19%)
- Clip or attachment fracture (17%)
- OVD fracture (12%)
- Opposing prothesis fracture (12%)
- Acrylic resin base fracture (7%)
- Prosthesis screw loosening (7%)
- Abutment screw loosening (4%)
- Abutment screw fracture (2%)
- Implant fracture (1%)

Regardless of the anchorage system, adjustments to the attachment were the most encountered mechanical problem in the mandible and the maxilla. In the maxilla, a 3x increase in OVD fracture rate has been reported.

Conclusion:

Lower implant survival and higher prosthetic complication rates have been reported in the maxilla compared to the mandible. The most encountered prosthetic complications involve the attachment system with the implant.

Mandible

Topic: Single Implant Overdenture
Author: Alsabeeha N, Payne AG, De Silva RK, Swain MV.
Title: Mandibular single-implant overdentures: a review with surgical and prosthodontic perspectives of a novel approach.
Source: Clin Oral Implants Res. 2009 Apr;20(4):356-65.
DOI: 10.1111/j.1600-0501.2008.01666.x.
Type: Review
Reviewer: Veronica Xia
Keywords: implant, over denture

Purpose:

- Review literature on mandibular single-implant overdentures (opposing complete max dentures) and present surgical and prosthodontic perspective of novel approach for this treatment

Materials and Methods:

- Electronic search

Results:

- 7 studies included
- 2 included studies with no implant failures
    - Cordioli 1997: single 3.75mm turned machined surface implants placed (10-15mm in length)
        - O-ring matrices replaced twice yearly
    - Krennmair and Ulm 2001: 3.75mm turned machined surface implants placed (13-15mm in length)
- 3 studies comparing conventional vs immediate loading protocols

    - Kronstrom 2007: included single and two-implant supported mandibular overdentures
        - Single implants placed at symphysis of mandible
        - 3/17 of immediately loaded implants failed
- Overall, review of literature included 57 implants place in midline symphysis to retain 57 mandibular single implant overdentures
    - 50.8% were 13mm in length
    - 17.5% were 10mm in length
- There is a lack of RCTs investigating this treatment
- Novel design: short/wide diameter roughened surface tapered implant
    - 8mm in diameter (available in 7, 9, and 11mm lengths)
    - Greater BIC, reduce stress concentration, and provide better stability for the prosthesis
    - Favorable placement of implant at center of the undersurface of the denture
    - Sx technique
        - Implants placed at midline of mandible in correct labiolingual positioning (bone leveling if necessary)
        - Healing abutment placed 2mm above mucosa and removed 6 weeks after sx, followed by earl loading

Conclusion:

- Limited literature on mandibular single implant overdentures (opposing maxillary complete dentures)
- Various loading protocols/implant systems, but always with a regular diameter implant
- Novel approach of used a short/wide implant is possible, but needs to be confirmed with randomized clinical trials.

Topic: 2 implant overdentures
Author: Rashid, et al.
Title: The effectiveness of 2-implant overdentures - a pragmatic international multicentre study
Source: J Oral Rehabil. 2011 Mar;38(3):176-84
DOI: 10.1111/j.1365-2842.2010.02143.x
Reviewer: Ryan Higgins
Type: Observational study
Keywords: 2-implant overdenture, conventional denture,

Purpose:

- To compare patient satisfaction with either conventional dentures or mandibular 2-implant overdenture

Materials and Methods:

- Survey given to patients at baseline and 6 moths post-treatment
    - Rated satisfaction on 100-mm visual analogue scare (VAS) questionnaire
    - Patients also completed a sociodemographic form
- The VAS questionnaire included questions on:
    - General satisfaction, ability to clean and speak, ability to chew, ratings of comfort, aesthetics, and stability
- 102 patients had valid baseline and 6-month satisfaction data
    - 52 complete dentures and 49 implant overdenture

Results:

- Implant overdenture groups reported significantly higher ratings of overall satisfaction, comfort, stability, ability to speak and chew
- For both denture types women rated the esthetics of their dentures lower than men

Conclusions:

- Despite the higher cost the relative satisfaction increase in the overdenture group compared to conventional denture group demonstrates the increased effectiveness of the 2-implant overdenture

Topic: Implant Overdentures
Authors: Schwartz-Arad, D et al.
Title: A Long-Term Study of Implants Supporting Overdentures as a Model for Implant Success
Source: J Periodontol 2005;76: 1431-1435.
DOI: 10.1902/jop.2005.76.9.1431.
Reviewer: Nicolas Lobo
Type: prospective cohort
Keywords: Bone loss/diagnosis; dental implants; dental implants, failure; denture, complete, lower; denture, complete, upper; denture, overlay; follow-up studies.

Purpose: to examine the survival and success rates of implants supporting overdentures, and how various factors affect the success of these implants

Materials and Methods: This study involved 62 patients, who received 285 implants to support 69 overdentures over a 10-year period (1990-2000). Implants placed using a two-stage protocol. A radiographic follow-up was conducted on 277 implants in 61 patients (68 overdentures), with a mean follow-up time of 37.93 months. Implants were either maxillary or mandibular and were rehabilitated with bar or ball attachments. The study measured crestal bone loss (CBL) using radiographs and evaluated implant success based on survival and bone loss, following modified criteria of Albrektsson et al.

Results: The study reported a 96.1% implant survival rate, with a cumulative survival rate (CSurR) of 95.4% over 10 years. Success was higher in the mandible (99.5%) compared to the maxilla (87.3%). Significant factors influencing implant survival included maxillary location, reduced implant surface, shorter implant length, and smoking. The overall success rate was 70.4%, with 195 of 277 implants showing bone loss of less than 0.2 mm per year. Smoking significantly increased crestal bone loss (CBL), with 56% of implants in smokers showing CBL, compared to 23.8% in non-smokers. Implants in the mandible showed lower CBL (80.8%) compared to those in the maxilla (41.9%), and immediate implant placement was associated with a 45.3% increase in CBL. Additionally, spontaneous exposure of implants (61.1%) and longer follow-up periods (≥3 years) contributed to higher CBL (77.1%). There was no significant correlation between implant dimensions and CBL, but coated implants had higher CBL rates (23.6%) compared to non-coated implants. Overdentures supported by two or four implants had better outcomes than those supported by six implants, with location playing a key role in implant success. The maxilla and follow-up period were the strongest predictors of increased CBL, with a 74% positive prediction rate.

Conclusions: The study found that the total survival rate of implants supporting overdentures was very high, the total success rate, based on CBL was primarily affected by implant in the maxilla and longer follow-up. Smoking, HA coating, and spontaneous exposure were linked to increased CBL. The study suggests new criteria for implant success should be established.

Topic: Implant overdentures
Authors: Van der Bilt, A, et al.
Title: Mandibular implant-supported overdentures and oral function
Source: Clin Oral Implants Res. 2010 Nov;21(11):1209-13

DOI: 10.1111/j.1600-0501.2010.01915.x.
Reviewer: Mahya Sabour
Type: clinical trial
Keywords: mandibular overdenture, implants, masticatory performance

Purpose: to assess the long-term effects of mandibular implant treatment on oral function

Material and Methods:

- 18 edentulous patients were re-evaluated 10 years after participating in an RCT where they received two mandibular implants and a new denture with magnet, ball-socket, or bar-clip attachments.
- Maximum bite force and masticatory performance were evaluated and compared to the same data from 10 years ago.

Results:

- 14 out of 18 of the patients participated. None had magnetic-retained mandibular overdentures and ball-socket and bar-clip type attachments were evenly distributed.
- NSD between the maximum bite force measured 8-14 months and 10 years after implant treatment. Implant attachments more than doubled the maximum bite force, compared to without implants (162 to 341N)
- The masticatory performance measured with implants was unchanged during 10 years. The performance was significantly improved with implants compared to without.

Conclusion:
Two mandibular implant overdentures significantly improve measures of oral function. Maximum bite force and masticatory performance remain unaltered after 10 years, lasting a long time.

Topic: mandibular dentures
Authors: Emami E, Heydecke G, Rompré PH, de Grandmont P, Feine JS.
Title: Impact of implant support for mandibular dentures on satisfaction, oral and general health-related quality of life: a meta-analysis of randomized-controlled trials
Source: Clin Oral Implants Res. 2009 Jun;20(6):533-44.
DOI: 10.1111/j.1600-0501.2008.01693.x
Reviewer: Amber Kreko
Type: systematic review
Keywords: implant overdenture, meta-analysis, oral and general health-related quality of life, patient satisfaction, randomized clinical trial, systematic review

Purpose: To examine the data published on the efficacy of the mandibular implant-retained overdentures from the patient's perspective.

Material and methods:

- Systematic review up to April 2007 for randomized controlled trials with patients wearing maxillary conventional dentures and either mandibular implant retained overdentures or conventional dentures,
- Outcomes included patient satisfaction, oral and general health related quality of life.

Results:

- 8 publications were included
- Implant overdentures in the mandible were rated more satisfactory than conventional dentures
- Lack of evidence to show impact of mandibular implant overdenture on perceived general health

Conclusions: Better patient-based outcomes with mandibular implant overdentures, but magnitude is inconclusive.

Topic: Implants in edentulous patients
Authors: Mericske-Stern RD, Taylor TD, Belser U
Title: Management of the edentulous patient
Source: Clin Oral Implants Res. 2000;11 Suppl 1:108-25
DOI: 10.1034/j.1600-0501.2000.011s1108.x
Reviewer: Tam Vu
Type: Review
Keywords: implant, prothesis, fixed, overdenture occlusion

Purpose: review use of ITI implants for prosthodontic rehab in completely edentulous arches

Discussion:
Indications for implants in completely edentulous jaws

- Main objectives:
    - To avoid removable complete denture
    - To stabilize complete dentures
- # of implants will determine type of prosthesis – more implants needed for fixed than OVD

Indications for OVD

- Mandibular OVD
    - Older pts with declining motor skills
    - Advanced atrophy → 2 implants → minimize risk to pts and tissues
    - 2 implants for Mn OVD = highly successful in older pts
        - Good alternative to fixed prosthesis ($$$ and time)
- Maxillary OVD
    - Pts who have natural teeth in opposing Mn or teeth/implant supported prosthesis (combination syndrome?? Study doesn't go into detail)
    - To replace failing fixed prostheses
    - Facial soft tissue support/esthetics
    - Better phonetics

Indications for fixed

- Younger pts
    - Usually w/full natural dentition or fixed reconstruction of opposing jaw
- Inability to adapt to removable prostheses
- Morphologic conditions that hinder removable
- Considerations for tx
    - Anatomic and morphologic structure of maxilla
    - Bone quantity
    - Esthetic considerations: facial support, tooth length, soft tissue management

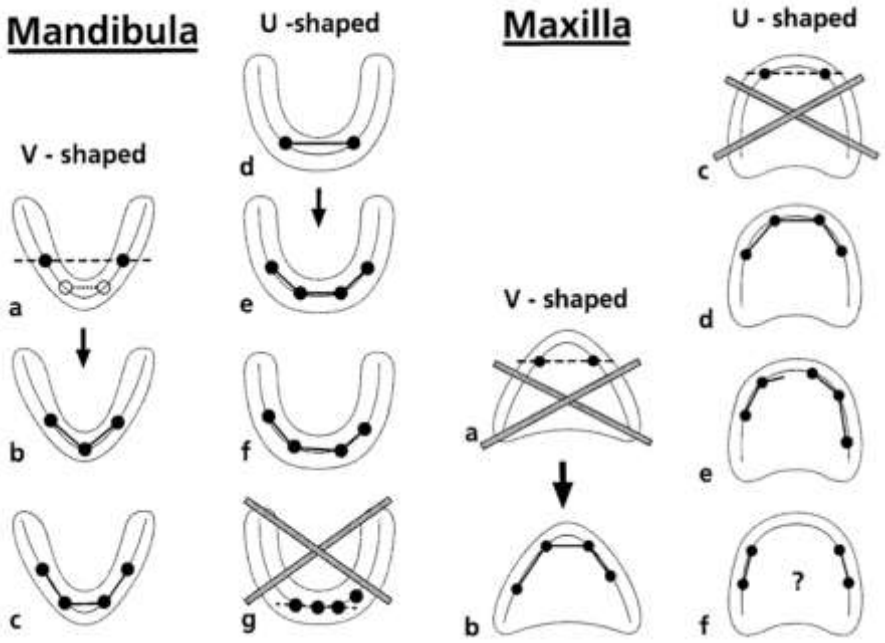
- Ease of repair
- Economics

Table 7.1. Summary: diagnostic criteria for the maxilla

Extraoral	Fixed	Removable	Intraoral	Fixed	Removable
Lip-line	Low	High	Ridge (shape)	Vertical	Buccal inclination
Tooth display	Little	Distinct		Convex	Buccal concavity
Facial support, lip support	No need	Necessary	Intermax. dist.	≤10 mm	>15 mm
			Intermax. relation	Neutral	Skeletal III
				Deep overbite	Crossbite
			Mucosa	Thick, keratinized	Thin, mobile

Number of implants and choice of prosthesis

- Mandibular OVD: **2 – 4 implants**
  - (length up to 8, shorter for atrophic ridge, diameter 3.3 mm – will need 3-4 implants)
  - 2 implants for Mn OVD → geriatric
  - 3 or 4:
    - if reduced diameter or length of 6 mm
    - length of bar segments must be adequate
  - 4: fixed cantilever-prostheses recommended as alterative



- Maxillary OVD: **4 – 6** well spaced implants, even distribution and connected by bar will enhance stability of OVD
  - Usually placed in anterior – can avoid sinus augmentation
  - preference:
    - Implant length ≥10 mm
    - Implant diameter 4.1 mm

    - Considerations:
        - Minimum # of implants not less than 4
        - Even distribution
        - 6 mm length avoided → incr failure rate
        - Reduced diameter (3.3) has to be combined with implants of standard diameter
- Fixed prosthesis: **4 – 6 implants**
    - Preference: 6 – 8 implants in each arch
    - Considerations:
        - >4 implants are necessary (6 – 8)
        - One implant per one missing tooth is not necessary
        - Congruence of implant and prospective tooth position is necessary
        - Segmented bridgework is option

Table 7.2. Number of implants and type of prosthesis

Location	Implants	Type of prostheses		Remarks
Lower Jaw	2	Overdenture	Bar	
• *anterior*		Overdenture	Ball anchor	Design of complete
	3–4	Overdenture	Bar (rigid)	
	4–6	Fixed cantilever prosthesis (screw-retained)		Cave: Cantilevers
		Bridgework		Cave: Cantilevers
• *anterior/posterior*	>4	Bridgework		2–3 segments
Upper Jaw	2	Overdenture	Ball anchor	Not standard, complete denture
	4–5	Overdenture	Bar (rigid)	Horseshoe-design
	>4–8	Bridgework		2–3 segments
		Individual abutments		Correction of axis

<u>Treatment planning</u>

- Most important step (surgical, prosthodontic, and lab)
- CT scan mandatory
- Surgical guide from radiographic templates or existing denture

<u>Abutment selection and impression technique</u>

- Retrievability --- in case of complication
- Screw and cement retained Provisionals
- One-step vs double impression technique

<u>Retention devices and design of protheses</u>

- OVD
    - Mn OVD -- 2 implants:
        - U-shape bar (rigid retention)
        - Egg-shaped Dolder bar (stress-breaking-hinge movement)
        - Ball anchors (stress-breaking)
        - Short distal cantilevers (5-7 mm) may be added to rigid bar, but total lengths must be shorter than central bar segment
        - Rigid bars = best distribution of vertical forces on implants
    - Mx OVD: multiple implants

        - Rigid bar recommended w/cast metal framework
        - OVD has horseshoe design
- Screw-retain cantilever prostheses
    - Favorable alternative to OVD in mandible
    - Higher precision fit, but need more manual skills for daily oral hygiene
- Fixed bridgework: screw-retained or cemented
    - Requires congruence of implant location and tooth position

2 implants, Mn OVD	• Bars • Single anchors
>2 Mn implants	• Rigid bar + OVD
≥4 Mn implants	• Rigid bar • Cantilever fixed protheses
4 – 6 Mx implants	• Rigid bar + OVD
6 – 8 Mx implants	• Full-arch fixed bridgework • Segmented bridge

<u>Esthetics and compromised situations</u>

- Esthetic more demanding in edentulous Mx → restoring **facial morphology + esthetics**
- Removal of buccal flanges
- Tx plan w/ prosth
- Compromised oral conditions
    - Acquired (trauma, cancer)
    - Congenital defects (cleft palate)
- Defects lead to impaired speech, chewing function, and esthetic issues
- May only be able to treat with removable prosthesis

<u>Occlusion</u>

- Full arch, implant fixed prosthesis – no specific evidence based occlusion developed
- Recommend:
    - Greater # of implants = greater rigidity of prosthetic connection and occlusal scheme w/ more freedom in centric
    - Balanced occlusion favors equilibration of occlusal load
- Occlusion concept in complete dentures
    - Cusp-to-fossa contacts in CO
    - Lingualized occlusion
    - Bilateral guidance
        - Provides primary stability during functional loading
        - Permit even distribution of load for restored implants
- Freedom in centric

    - Indicated in multiple implants supporting bridgework
    - Rigid support
    - Group fxn for implants distribute loading forces equally
    - No balancing contacts on cantilevers

Topic: Partially edentulous
Authors: Abt E, Carr AB, Worthington HV.
Title: Interventions for replacing missing teeth: partially absent dentition.
Source: Cochrane Database Syst Rev. 2012 Feb 15;(2):CD003814.
DOI: 10.1002/14651858.CD003814.pub2.
Reviewer: Daeoo Lee
Type: Cochrane review
Keywords: edentulous, implant, partial
Purpose: To assess the effects of different prostheses for the treatment of partially absent dentition in terms of the following outcomes: long-term success, function, morbidity and patient satisfaction.

Material and methods:

- Different prostheses partially edentulous:
    - Removable dental prostheses (RDPs) -tooth and tooth-tissue supported.
    - Fixed dental prostheses (FDPs) -tooth supported.
    - Treatment for shortened dental arch -FDP versus RDP.
    - Implant supported FDPs versus tooth/implant supported FDPs.
- Electronic database search (- March 2011)
- Hand searching (Nov 2010)

Results:

- 21 studies included
- Review falls short of the objective! Insufficient studies.
- Removal dental prostheses (RDPs): insufficient evidence
    - Comparing different designs:
        - Different direct retainers: based on design of clasp (I-bar and circumferential)
        - Different major connectors: lingual bar vs. plate (16.81 vs. 14.82), SSD but clinical significance questionable
        - Different minor connectors: NSSD between 3 different types (tilting, functional, and sanitary)
    - Comparing different materials: titanium vs. chromium-cobalt
    - Comparing different fabrication techniques: one piece cast vs. altered cast technique
- Fixed dental prostheses (FDPs)- tooth supported: insufficient evidence
    - Comparing different design
        - Retention- cement vs. screw retained implant crowns
        - Toot/implant FDPs with rigid vs. non-rigid connectors
    - Comparing different materials
        - High gold alloys vs. other material
        - Gold framework or gold alloy vs. other material

        - Zirconia vs. other materials
        - Cements
        - Abutment
- Treatment for shortened dental arch: (FDP vs. RDP) insufficient evidence
    - Prosthesis survival
    - Caries
    - Patient satisfaction
- Fixed dental prostheses – (Implant vs. tooth/implant supported): insufficient evidence

Conclusions:
There is insufficient evidence to recommend one prosthetic intervention versus another for patients with partial edentulism. There is much need to do research in this area.

Topic: Implant-assisted RPDs
Authors: Mijirisky E.
Title: Implants in Conjunction With Removable Partial Dentures: A Literature Review
Source: Implant Dent. 2007 Jun;16(2):146-54.
DOI: 10.1097/ID.0b013e3180500b2c.
Reviewer: Cyrus J Mansouri
Type: Literature review
Keywords: partial dentures – dental implants – review

Purpose:
To review the literature regarding the use of implants to improve outcomes with removeable partial dentures and evaluate indications for the clinical approach.

Material and methods:
A literature search was completed from 1990-2006 for articles focusing on residual ridge resorption, need and demand for prosthodontic treatment, and cost-effectiveness of dental treatment related to implants and RPDs.

Results:
<u>Considerations for Kennedy class I and II cases</u>
Common complaints associated with Kennedy class I and II RPDs are lack of stability, minimal retention, unesthetic retentive clasping, and discomfort upon loading. Combination syndrome is also a common problem associated with the mand class I RPD opposing a maxillary CD (downgrowth of the maxillary tuberosities, papillary hyperplasia, resorption of the premaxilla, overeruption of the mandibular anterior teeth, and resorption of the posterior mandible). An advantage of using posterior implants in the mandible is the ability to reduce the distal extension of the denture base. Similarly, a single dental implant can reduce the instability of a class II situation, creating a smaller effort arm and improving the fulcrum position.

The following clinical studies were reported, describing posteriorly placed implants in the mand first molar area to improve retention and reduce need for retentive clasps. In general, reduced degenerative bony changes, improved patient perceptions, and stable implant conditions were reported. Reduced effort arm and improved fulcrum position was reported in class II situations.

Keltjens 1993 and Halterman 1999 described clinical cases using 2 implants to assist a mand class I situation, with implants in the first molar area. In one clinical case, no retentive elements to the RPD were required. In these short-term cases, VDO was better maintained to prevent the degenerative changes described by Kelly 1972.

Griffin 1996 reported a class II case where a single implant was used at a molar area with an extracoronal resilient attachment. The patient reported a more natural feel during mastication on the implant side over the tooth supported side.

Mitrani 2003 described a retrospective study of 1–4-year follow-up in 10 class I or II cases treated with posterior implants to provide additional stability and remove retentive clasps when possible. Results reports consistently increased satisfaction in all pts, minimal prosthetic/component wear, no radiographic evidence of excessive bone loss, and stable peri-implant conditions.

Kuzanovic 2004 reports the use of a class I case where 2 posterior implants were used with ball attachments. No complications were encountered after 2 years.

Residual ridge resorption related to implants and RPD – General aspects
It is evident that denture use in the mandible is associated with an unfavorable pressure in the edentulous areas which leads to resorption over time compared to no denture. Kordatzis 2003 reported 1.63 mm vertical resorption of the residual ridge in conventional denture groups compared to 0.69 mm in an implant OVD group. Mijiritsky 2005 also reported strategically placed implants reduces the excessive effort force on the residual ridge produced by the distal extension. The reduced resorption also results in less need for denture relining to maintain posterior support. Posteriorly placed implants also remodel and stimulate the surrounding bone, resulting in better stability of the surrounding bone.

Long-term studies
The above findings are corroborated by long-term studies reporting 100% implant survival rate, absence of tooth mobility or caries, superior patient satisfaction, and only minor prosthetic complications.

Minimal teeth remaining – rigid connection between teeth and implants
Cases have been reported where 1-3 teeth in the arch were retained and a RPD was fabricated with intricate designs paired with the additional support of dental implants. In general, these retaining teeth increased complexity of RPD design and increased tx cost and time. A rigid connection was made between the remaining teeth and dental implants, putting increased stress on the dental implants due to the lack of PDL.

Cost-benefit
Value of the treatment is created in the eyes of the patient only when satisfaction with tx outcomes > cost incurred. A great number of patients decline tx due to not understanding the value it represents. A reported 50% saving on treatment costs has been reported by using implant + RPD compared to fixed implant supported restorations alone. In general and without sacrificing biofunctional and prosthodontic principles, less implants = greater value to patient.

Conclusion:
A limited number of strategically placed implants can establish a favorable RPD design by significantly reducing the effort arm and improving the fulcrum line. Additional retention, less unesthetic retentive arms, reduced ridge resorption, and improved patient perception and satisfaction are also reported.