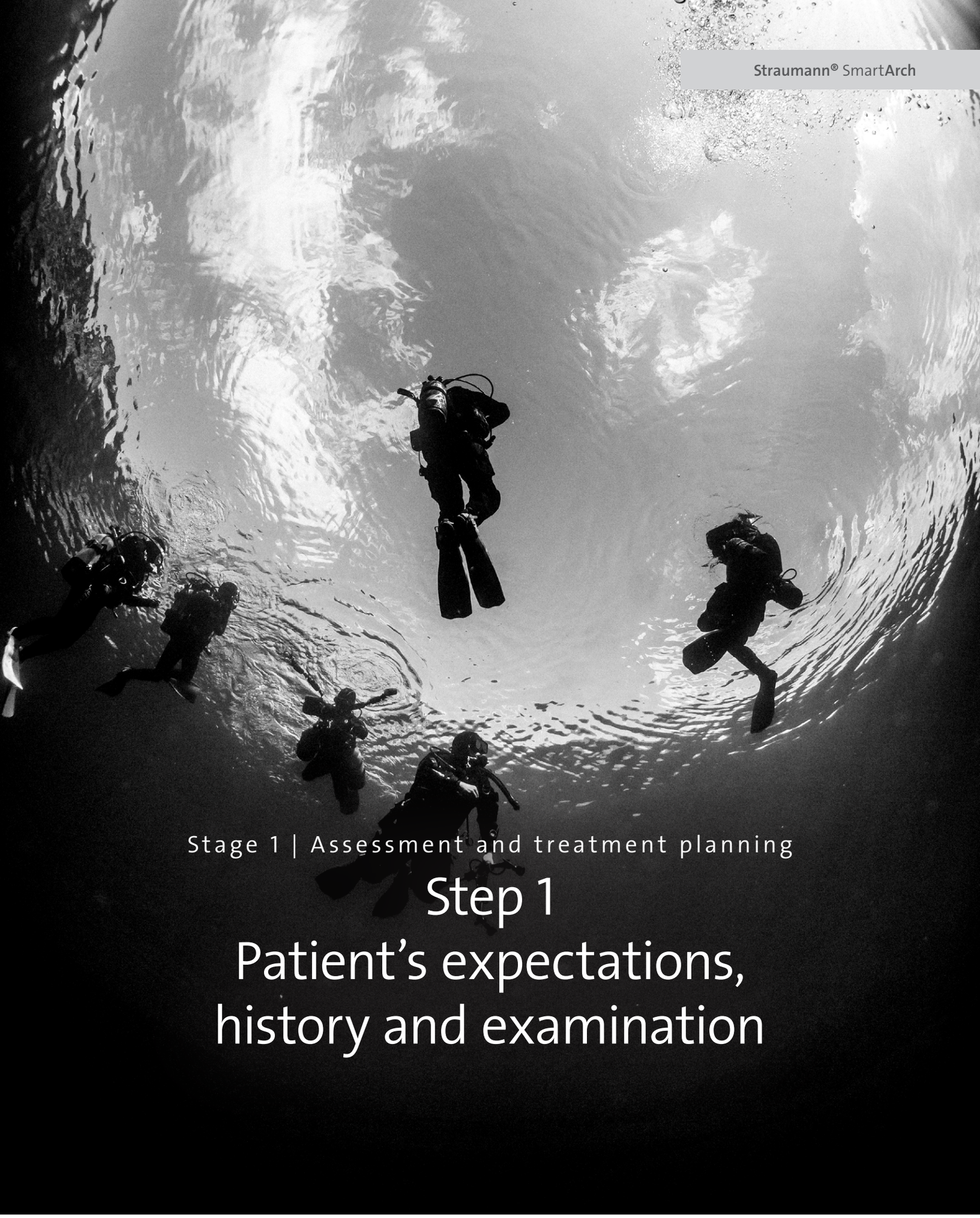


Stage 1 | Assessment and treatment planning

Step 1
Patient's expectations, history and examination

straumann
simply doing more

Assessment and treatment planning

- Step 1 | Patient's expectations, history and examination
- Step 2 | Treatment planning
- Step 3 | Consultation and consent
- Step 4 | Fabrication of the surgical drill template

Surgical procedures

- Step 1 | Implant surgery
- Step 2 | Post-operative review and suture removal

7–10 days

6–8 weeks

Prosthetic procedures

- Step 1 | Abutment insertion, modification and relining of a lower complete denture
- Step 2 | Lab-side relining of a lower complete denture
- Step 3 | Insertion of the final overdenture and patient instructions

1 week

Aftercare and maintenance

- Step 1 | Review visit
- Step 2 | Maintenance visit

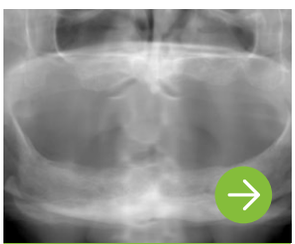
3–6 months (or as necessary)

In clinic with patient *Office / Lab work*

Contents

Introduction

Successful implant treatment in the edentulous mandible starts with the history and examination of the patient and an understanding of the patient's expectations. This step comprises three essential elements for creating an accurate patient assessment, diagnosis and proper treatment plan:



1. Patient history

A fully comprehensive patient medical and dental history, to gather profound knowledge of the patient's wishes, expectations and medical risk factors.

2. Examination

A thorough clinical and radiographic examination, to gather information about the extraoral and intraoral situation to help formulate the diagnosis and treatment plan.

3. Provisional diagnosis and tentative treatment plan

A discussion with the patient about the diagnosis, treatment options and costs, will help the patient make an informed decision about their treatment.

Click on the graphic to go directly to the chapter.

Using this systematic approach, you will be able to identify potential risk factors and/or contraindications for implant treatment. From the findings in this visit, you can discuss with the patient their general dental health status and possible treatment options. This will help both you and the patient to have a mutual understanding regarding requirements, expectations, and limitations, and to prepare for upcoming treatment sessions. All findings and discussions should be documented in the patient's records and dated for future reference.

Patient's expectations, history and examination comprises:

- understanding the patient's expectations
- patient history
- examination
- provisional diagnosis and tentative treatment plan.

Learning objectives

- Be able to conduct a structured patient assessment to gather details of the patient's medical and dental history.
- Recognize the absolute and relative general and medical contra-indications for implant treatment.
- Conduct a thorough extraoral and intraoral clinical examination, and look for site-specific factors, which are relevant for implant treatment planning.
- Know how to assess the patient's existing lower denture and be able to decide whether the denture can be converted into an implant-overdenture or has to be replaced.
- Be aware of the success and survival rates of different treatment options to be able to discuss the benefits and risks of treatment with the patient.

1. Patient history

Before planning surgery, the patient's psychological and physical health status should be carefully assessed. It is important to record, regularly check, and update all such information in the patient's records. The knowledge of former and current diseases, surgeries, and medications helps you identify patients at risk. **Should you have any doubts or concerns, or if the patient has any serious internal medical problems, always consult the patient's physician or medical specialist for further clarification.[1]**

Understand the importance of the patient's history and record keeping.

Caution: Important findings which may present psychological and psychiatric risk factors for a successful implant treatment include:

- Denture intolerance
- Unusual number of existing dentures
- Inability of the patient to describe their request/problem
- Psychoses

In addition to psychological factors, various systemic conditions and their treatments are risk factors in implant therapy[1]. These factors can determine whether or not a patient is suitable for implant placement[2]. The level of evidence supporting absolute and relative contraindications for oral implant therapy due to systemic conditions and treatments is low. The largest amount of information exists for diabetes mellitus, osteoporosis, and radiotherapy.

Be aware of the risk factors in implant therapy.

You may use this example of a Medical Record Form to document a comprehensive list of information about the patient's medical history.

Always read the instructions for use of any product that you are considering to use in the patient's treatment.

1.1 Absolute contraindications for implant placement[3,4]

If one or more of the following serious internal medical problems is present, you should consider non-surgical treatment alternatives to restore the patient's dentition, or refer the patient to a specialist oral surgeon:

Avoid implant treatment if the patient has any of these absolute contraindications.

- Recent myocardial infarction or cerebrovascular accident (≤6 months ago)
- Valvular prosthesis surgery (≤6 months ago)
- Previously irradiated bone in the head or neck area
- Intravenous bisphosphonate therapy
- Ongoing chemotherapy
- High-dose immunosuppressive therapy
- Allergies to implant materials (e.g., Titanium Grade 4)
- Lack of compliance
- Incomplete maxillary and mandibular growth
- ASA 5 or 6[5]

1.2 Relative general and medical contraindications

- Poor general state of health
- Uncooperative and/or unmotivated patient, with inadequate oral hygiene
- Uncontrolled diabetes mellitus
- Uncontrolled bleeding disorders or patient who is on antithrombotic medication
- Immunocompromised patient
- Bone metabolism disturbances
- Prolonged therapy-resistant functional disorders (e.g., craniomandibular disorders)
- Inadequate wound healing capacity
- Tobacco, drug or alcohol abuse
- Oral bisphosphonate therapy
- Allergies to local anesthetics, which may require referral to a specialist
- Pathologic diseases of the jaw or oral mucosa, or unfavorable anatomic bone conditions
- Uncontrolled periodontitis in the antagonistic jaw
- Acute infection of proposed implant sites
- Severe bruxism or parafunctional habits
- Local root remnants
- Pregnancy
- Psychoses

Consider if the benefits of implant treatment outweigh the risk of complications and be able to discuss this with the patient.

Smoking and periodontitis are commonly encountered risk factors when assessing a patient for implant treatment. You can find more detailed information about these two topics on the following page.

1.3 Smoking as a risk factor for implant therapy[6]

Smoking is not an absolute contraindication for implant placement but it lowers the survival and success rates for implants. It is also a risk factor for general and oral health. Smoking has a long-term chronic effect on the immune system and inflammatory processes. Some deleterious effects of smoking include: impaired wound healing, reduced collagen production, impaired fibroblast function, reduced peripheral circulation, and compromised function of neutrophils and macrophages.[6]

Smoking lowers the survival and success rates of implants.[6]

Smoking can cause:

- 4 - 5 times higher risk of peri-implantitis compared with non-smokers
- 2 - 10 times higher risk for progressive bone loss compared with non-smokers
- reduced implant survival rates compared with non-smokers.

Smoking can increase the risks[6] of:
– peri-implantitis
– progressive bone loss
– implant loss.

Therefore, motivating the patient to stop smoking will be beneficial both for implant treatment and their general health.

Motivate your patient to stop smoking.

1.4 Periodontitis as a risk factor for implant therapy[6]

Implant placement in patients with a history of periodontitis is not contraindicated, as the majority of studies report implant **survival rates** greater than **90 %**. However, there is a **3-4-fold** increased risk of developing peri-implantitis. Microbial colonization following implant placement has been shown to occur within a short period of time; the composition of microbiota within the peri-implant sulcus is similar to that found at neighboring teeth in partially dentate patients. Successful treatment of periodontitis prior to implant placement and individualized maintenance care following implant treatment is important.

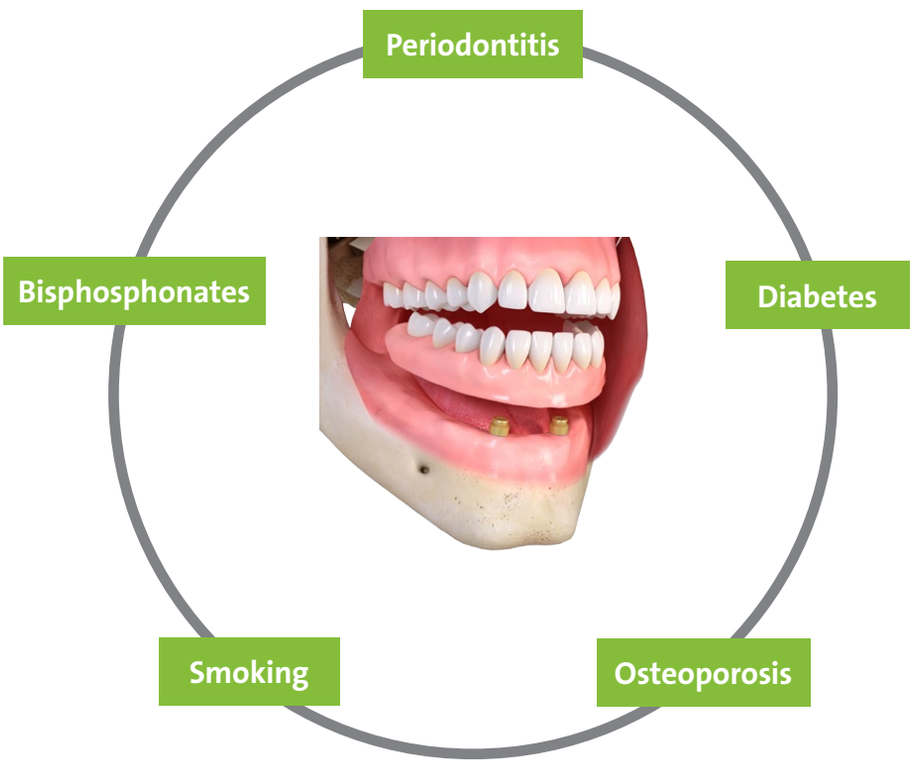
Periodontitis can increase the risk of peri-implantitis[6].

Successful treatment of periodontitis is a prerequisite for implant treatment.

1.5 Combined risk factors

One single factor alone may not influence the risk of treatment failure measurably, whereas a combination of multiple independent factors may have a significant impact on the treatment outcome.

Several risk factors may increase the overall risk of treatment failure.



1.6 Checklist for patient history

For a thorough patient history, you may use this example of a Clinical Record Form to document the following:

Example of a clinical record form.

☐ **Patient's chief complaint and expectations**

During this first visit, discuss in detail the following questions with your patient:

- Why is the patient here, what is his or her primary objective?
- What are the patient's 3 main complaints and what is their ranking?
- What features of the patient's existing denture would they like (to keep)?
- What are their expectations regarding the treatment outcome in terms of esthetics, function and quality of life?
- What does the patient know about implant therapy? Are their knowledge and expectations realistic?

After completion of this point, verify whether implant treatment can solve the patient's issues. Formulate a prognosis for every complaint and identify unrealistic expectations.

☐ **Medical history**

Before planning surgery, the patient's general psychological and physical health status should be carefully assessed. It is important to record, regularly check, and update all such information in the patient's records. The knowledge of former and current diseases, surgeries, and medications helps you identify patients at risk. **Should you have any doubts or concerns, or if the patient has any serious medical problems, always consult the patient's physician or medical specialist for further clarification.**[1]

You may use this example of a Medical Record Form to document a comprehensive list of information about the patient's medical history. It is helpful to ask the patient to bring a list of their current medications for this visit.

Example of a medical record form.

☐ **Dental history**
- Previous dental care, especially number of existing dentures
- Reasons for tooth loss
- History of treated periodontitis
- Oral hygiene and denture wearing habits

☐ **Social and family history**
- Financial capability
- Family predisposition for tooth loss

☐ **Habits**
- Parafunctional activity (e.g., bruxism)

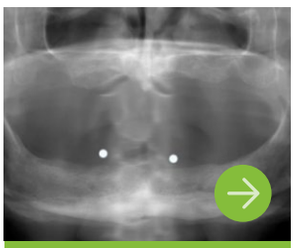
☐ **Motivation and compliance**
- Patient's motivation to invest time and money in oral health
- Frequency of oral hygiene procedures
- Patient's ability to perform oral hygiene procedures (manual dexterity)

2. Examination

A thorough examination for accurate diagnosis and treatment planning includes the following:

2.1 Clinical examination

- General
- Intraoral examination: implant site-specific



2.2 Radiographic examination

- Radiographic template
- General

Accurate diagnosis and treatment planning requires:
– Clinical examination
– Radiographic examination.

2.1 Clinical examination

2.1.1 General

The following clinical assessments should be made for a thorough diagnosis and treatment plan:

Systemically perform extraoral, functional and intraoral (general and implant site-specific) assessments.

a. Extraoral examination:

- Assess appearance and structure of extraoral hard and soft tissues
- Swelling or lesions
- Asymmetries
- Palpation of lymph nodes, head and neck muscles, temporomandibular joint
- Lower face height and lip support
- Length of the incisors and the occlusal plane (smile)
- Contours of the mandible.

b. Functional examination:

- Check static and dynamic occlusion and function with existing denture:
  Interocclusal distance, speech, vertical dimension of occlusion (VDO), maxillo-mandibular relationship, overbite, overjet, centric relation, slide-in-centric, lateral and anterior excursive contacts, signs and symptoms of temporomandibular joint disorders.

c. Intraoral examination: general

Assess:

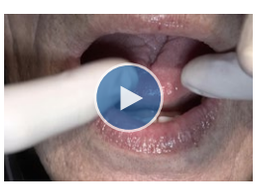
- Oral hygiene status
- Dental, periodontal and restorative condition of remaining teeth in the antagonistic jaw
- Amount and consistency of saliva
- Appearance and structure of intraoral hard and soft tissues.

Caution:

- Be aware of denture stomatitis.
- Be aware that the presence of squamous cell carcinoma increases with age and is often under the tongue[7].

2.1.2 Intraoral examination: implant site-specific

Video: Intraoral clinical examination



a. Bucco-lingual width of bone

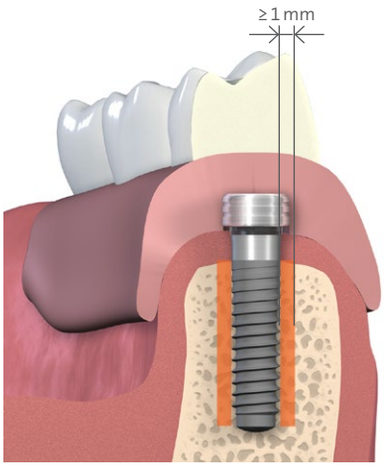
A restoratively-driven orofacial implant position and axis is important in planning for implant-supported restorations. This can be done by:

- Assessing the contours of the mandible and alveolar ridge by palpation.
- Visually evaluating the available orofacial space for an implant.
- Being aware of the presence of concavities (lingual undercuts in the mandible).
- Assessing the consistency of the overlying tissues of the alveolar ridges.

Assess:
- alveolar ridge contours and overlying tissues
- orofacial space
- lingual undercuts.

The bucco-lingual bone wall must be at least **1 mm** thick to ensure stable hard and soft tissue conditions.

Ensure sufficient alveolar bone (1 mm) around each implant.



⚠ If the overlying tissue is fibrous or thick, accurate assessment may be difficult with visual assessment and palpation. Probing of the local tissues with an endodontic file with a rubber stopper under local anesthesia may be indicated to assess soft tissue thickness and to confirm the presence of sufficient alveolar bone.

Implant type	Endosteal diameter (mm)	Minimum bucco-lingual width of bone (mm)
Standard Plus Narrow Neck CrossFit® (SP NNC)	3.3	5.5
Bone Level Tapered Narrow CrossFit® (BLT NC)		
Bone Level Tapered Regular CrossFit® (BLT RC)	4.1	6.0
	4.8	7.0

SP NNC Implants require a ridge width ≥5.5 mm.

BLT Implants require a ridge width:
≥5.5 mm for ∅ 3.3 mm NC.
≥6 mm for ∅ 4.1 mm RC.
≥7 mm for ∅ 4.8 mm RC.

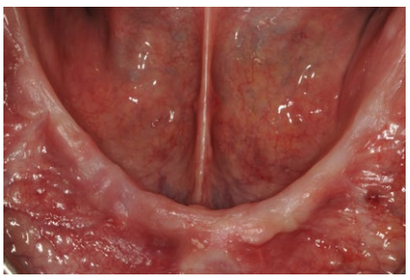
→ Chart of minimum bucco-lingual width of bone for SP NNC Implants.

→ Chart of minimum bucco-lingual width of bone for BLT Implants.

b. Soft tissue condition in the edentulous area

Shape, color and texture are significant characteristics to assess the mucosa. 4 mm of width of the keratinized mucosa is required in the area of each planned implant. Thus, an adequate collar of keratinized tissue of **at least 2 mm** circumferentially to the implant provides a protective cuff around the implant to[8]:

At least 2 mm of keratinized tissue is required buccal and lingual to each implant.



- Resist trauma from mastication
- Provide a strong cuff of peri-implant tissue
- Allow for convenient prosthetic procedures and oral hygiene measures.

Caution: More plaque and mucositis is found around implants surrounded by keratinized mucosa thinner than 2 mm[9].

<2 mm keratinized mucosa results in more plaque accumulation and mucositis.

c. Examination of the existing denture

Assess the existing denture:

Examine the patient's existing denture, including general condition and structural factors, appearance, hygiene, fit and retention.

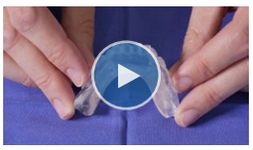
- Condition of the denture: check the base, denture body and tooth wear by visual inspection or scratching with a metal instrument (e.g. for fractures and cracks)
- Metal reinforcement within the denture that could potentially interfere with the area that needs to be hollowed out for the attachment components
- Appearance
- Hygiene
- Fit of the denture with a silicone wash impression
- Retention and stability
- Vertical dimension of occlusion (VDO)
- Position of the dental arch (space for the tongue).

The existing denture should be duplicated by your dental technician with transparent acrylic resin and used as a radiographic or surgical drill template.

2.2 Radiographic examination

Standard dental radiographs allow an initial assessment of the bone levels available for implant treatment; however, these 2-dimensional images give no indication of ridge width.

Video: Radiographic examination using a radiographic template and Straumann® X-ray Reference Spheres



2.2.1 Radiographic template

The Straumann® X-ray Reference Sphere can be used when taking site-specific radiographs. Basically, there are two options:

1. Duplicate the patient's existing lower denture in transparent acrylic resin and put the metal X-ray Reference Spheres in the region of interest. This is often in the canine region. **This template is fabricated by your dental laboratory beforehand.**

Be aware of the options for X-ray templates, i.e. acrylic resin duplicate of patient's denture with Reference Spheres, thermoplastic splint.

2. Alternatively, a temporary denture base (thermoplastic splint) can be manufactured on the cast of the edentulous ridge. X-ray Reference Spheres are fixed/attached in the region of interest.

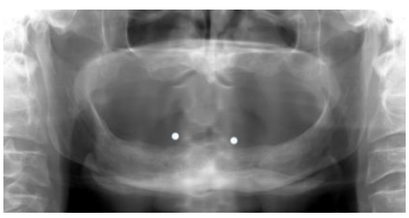
Check that the patient's existing lower **denture fits perfectly** on the underlying soft tissue as the complete lower denture has to perfectly mirror the actual situation in the patient's mouth before it can be duplicated. If this is not the case, take a silicone wash impression before duplication. A stable template is important for proper guidance during surgery.

Be aware of the importance of good denture fit prior to duplication.

2.2.2 General radiographic examination

The general condition of the bone, in particular the interforaminal area and adjacent vital structures (nerve canals and foramina) should be assessed. Other structures, such as foreign bodies, impacted teeth, etc., must equally be evaluated. Inflammatory lesions in the vicinity of an implant site may compromise the implant treatment.

Assess relevant anatomical structures and pathology using radiographs.



Panoramic radiographs provide an overview of:

- Potential anatomical anomalies and lesions or pathologies
- Overall condition of supporting bone
- Available bone height
- Location of the inferior alveolar nerve canal
- Location of the mental foramen.

Panoramic radiographs assist you in visualizing important aspects for implant treatment.

Caution: OPT images are subject to distortion (up to 25 % magnification) and superimposition of anatomical structures (zygoma, oro-pharynx, tongue, spinal column). The magnification in panoramic images varies between different types of panoramic machines and must be considered accordingly.

Determine the correct distortion factor for radiographic planning with the X-ray Reference Spheres.

For more detailed radiographic examination, refer to Step 2 Treatment Planning.

2.3 Summary of considerations in the patient history and initial examination

Before making a diagnosis and treatment plan for the patient, consider these prerequisites for a straightforward case using the Straumann® SmartArch solution:

Understand the prerequisites for straightforward implant cases in the edentulous mandible.

1. Last tooth extraction at least 4 months prior to treatment
2. Edentulous mandible with an existing lower complete denture with a desire for better retention and stability. However, there is no need for a replacement in terms of esthetics, occlusal wear, vertical occlusal dimension and denture hygiene
3. Sufficient alveolar ridge width and height for implant placement without bone augmentation, and attached mucosa of at least 4 mm width in the canine region
4. Healthy patient (ASA-1: a normal healthy patient; or ASA-2, a patient with mild systemic disease)[5] with undisturbed wound healing capacity
5. Good patient motivation and compliance, preferably a non-smoker
6. Conventional loading protocol (≥ 3 months after implant placement)
7. Minimum vertical oral opening space of 30 mm to allow access with surgical instruments.

Caution: Any pathologic condition such as caries, periapical infections or periodontitis in the antagonistic jaw, temporomandibular joint disorders or oral mucosal lesions should be treated prior to implant placement.

Be aware of conditions requiring treatment prior to implant placement.

In cases of residual probing depths (PD) ≥ 5 mm with concomitant bleeding on probing in the antagonistic jaw, full-mouth plaque scores > 20 %, and associated risk factors, pre-treatment and periodontal re-evaluation are mandatory before implant placement.

2.4 Checklist for examination

CLINICAL EXAMINATION

Checklist for clinical examination

- [ ] **Conduct the general clinical examination thoroughly. You may use this example of a Clinical Record Form.**
- [ ] **Conduct the site-specific clinical examination as follows:**
  - [ ] Bucco-lingual width of bone
    - Assess the contour of the ridge by palpation.
    - Visually evaluate the available orofacial space for an implant.
    - Check for concavities or lingual undercuts.
  - [ ] Minimum vertical mouth opening and inter-occlusal distance
  - [ ] Soft tissue condition in the edentulous area
    - Use a periodontal probe to assess the health, form and metrics of the gingival biotype.
    - Assess the width of the keratinized mucosa with a periodontal probe.

CHECKLIST FOR RADIOGRAPHIC EXAMINATION

Checklist for radiographic examination

- [ ] **Radiographic template:** Create a template (duplicate of the patient's existing well-fitting denture) with Straumann® X-ray Reference Spheres to carry out radiographic examination.
- [ ] **General:** Take a panoramic X-ray of the patient.

3. Provisional diagnosis and tentative treatment plan

You may already have a provisional diagnosis and tentative treatment plan during this first visit with your patient. Your legal obligation* as a dentist is to provide your patient with information on the planned procedure, so that he or she has a clear understanding of the diagnosis and treatment options.

Provide easy-to-understand information about the planned procedure and alternative treatment options.

The major benefits of supporting an existing complete lower denture with two intraforaminal implants are:

- Improved general satisfaction with implant-supported denture[10,11]
- Improved oral health-related quality of life[11]
- Improved chewing efficiency and increased subjective chewing comfort
- Better retention and stability.

Be aware of the key benefits of the use of dental implants to support an overdenture.

3.1 Treatment options for the edentulous lower jaw.

No treatment - conventional complete denture

Implant-supported overdenture

Fixed implant-supported prosthesis

Be familiar with the different treatment options for the edentulous mandible.

*Liabilities are subject to local or regional jurisdiction. In general, the dentist providing the care is responsible for providing accurate and complete informed consent including the prognosis of the treatment, possible complications and alternative treatment options. This information to the patient should be made available prior to the procedure and not on the day of surgery. We recommend documenting this informed consent in writing.

3.2 Risks and benefits of implant treatment

Potential benefits of implant placement should outweigh the associated risks compared to more traditional prosthodontic treatment options. Hence, the patient has to decide which treatment option is best suited based on the affordability of the treatment proposed versus the anticipated benefits.

Ensure that the benefits of implant treatment outweigh the associated risks compared to other restorative treatment options.

Be aware of the risks and benefits of all treatment options for an edentulous mandible.

Treatment option	Benefits	Risks/Disadvantages	Recommended in the following situations
Conventional complete denture 	• Cost savings • No surgery • Treatment time • Easy to clean	• Bone resorption • Chewing efficiency • Poor retention	• No patient demand for improvement • Medically and anatomically compromised patients
Implant-supported overdenture 	• Strong retention and stability • Good chewing efficiency[10,11] • Helps to preserve peri-implant bone • Higher oral health related quality of life[10,11] • Easy to compensate loss of hard/soft tissue volume • Moderately easy to clean	• Moderate costs • Surgical procedure • Risk for peri-implantitis if hygiene is not adequate	• Patient demand for more stability of denture and quality of life
Fixed implant-supported prosthesis 	• Psychological benefits and oral health related quality of life	• High costs • Surgical procedure • Treatment time • High compliance needed • Complicated to compensate loss of hard/soft tissue volume • Difficult to clean	• Patient demand for fixed denture

Poor denture retention can also be improved with adhesives, which might be an alternative option for medically compromised patients.

3.2.1 Survival rates of implants supporting overdentures

Survival of **implants** supporting overdentures: 95 % up to 5 years.[12,13,14]

- Most studies available on mandibular overdentures report a success rate of over 90 %.[13,14,15]
- Neither the number of supporting implants nor the type of attachment system has been found to affect the rate of survival.

Be aware of the survival rates and clinical complications of implant-supported overdentures.

3.2.2 Survival and complication rates of implant-supported overdentures

More than **80 %** of implant-supported overdentures remain in continuous service after 10 years.[15]

Technical complications to be expected after 5 years[16,17]

- Loss of retention (Matrix activation, change of LOCATOR® Replacement Males; 30 %)
- Loss of stability (Rebasing or relining of the overdenture; 19 %)
- Wear of retentive elements
- Overdenture fracture (12 %)
- Abutment screw loosening (7 %)

3.3 Checklist for provisional diagnosis and tentative treatment plan:

Checklist for the provisional diagnosis and tentative treatment plan.

☐ **Discuss with the patient about the:**

- Diagnosis or chief complaints
- Treatment option(s) available
- Risks, benefits and indication of each treatment option (success and failure rates)
- Estimated cost and treatment time of each option
- Formulate a prognosis of the agreed treatment and estimate the risk of failure of the agreed treatment
- Agree on the expected outcome of the treatment in order to set the basis for the chosen treatment procedure.

If not all information is present at this first visit, plan for a second visit with the patient to present the definitive treatment plan and gain his or her informed consent.

4. Checklist of information to be provided to the patient

Checklist of information to be provided to the patient.

- [ ] **General information about implant treatments**
- [ ] Overall treatment time: total treatment time generally takes 3 to 4 months for a straightforward case from placing the implants until delivery of the overdenture
- [ ] Number, frequency and duration of appointments
- [ ] Type of implants and materials to be used
- [ ] Expected discomfort from the procedures and period of limited denture comfort
- [ ] Approximate estimation of treatment costs and maintenance

Chart of minimum widths of bone for planning which SP NNC Implant to use

Implant type (endosteal diameter)	Shoulder diameter (mm)	Bucco-lingual or bucco-palatal width of bone (mm)	Recommended use for Straumann® Smart cases
SP ∅ 3.3 mm NNC 	3.5	5.5	For narrow edentulous bone ridges. **Caution/Precaution:** Small-diameter implants are not recommended for the posterior region.

Chart of minimum widths of bone for planning which BLT (NC/RC) Implant to use

Implant type (endosteal diameter)	Shoulder diameter (mm)	Bucco-lingual or bucco-palatal width of bone (mm)	Recommended use for Straumann® Smart cases
BLT ∅ 3.3 mm NC 	3.3	5.5	For narrow interdental spaces and narrow partially or fully edentulous bone ridges. **Caution/Precaution:** Small-diameter implants are not recommended for the posterior region.
BLT ∅ 4.1 mm RC 	4.1	6	For use in the maxilla and mandible, for restoration of partially or fully edentulous patients.
BLT ∅ 4.8 mm RC 	4.8	7	For use in the maxilla and mandible, for restoration of partially or fully edentulous patients in wide interdental spaces and bony ridges.

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Assessment and treatment planning

Step 1 | Patient's expectations, history and examination

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