Chapter 7

Summary

Prosthetic rehabilitation of patients with a compromised intraoral and extraoral condition is challenging. Examples of those patients are head and neck cancer patients and patients with Sjögren's syndrome. While rehabilitation of these patients with conventional prostheses frequently results in an unsatisfactory or suboptimal treatment outcome, rehabilitation with implant-retained prostheses is in favour of a better treatment outcome (chapter 1). The research described in this thesis assessed the treatment outcome of implant therapy in head and neck cancer patients and patients with Sjögren's syndrome.

In **chapter 2** the long-term treatment outcome of implant-retained overdentures on mandibular implants inserted during ablative surgery (so called primary inserted implants) is described.

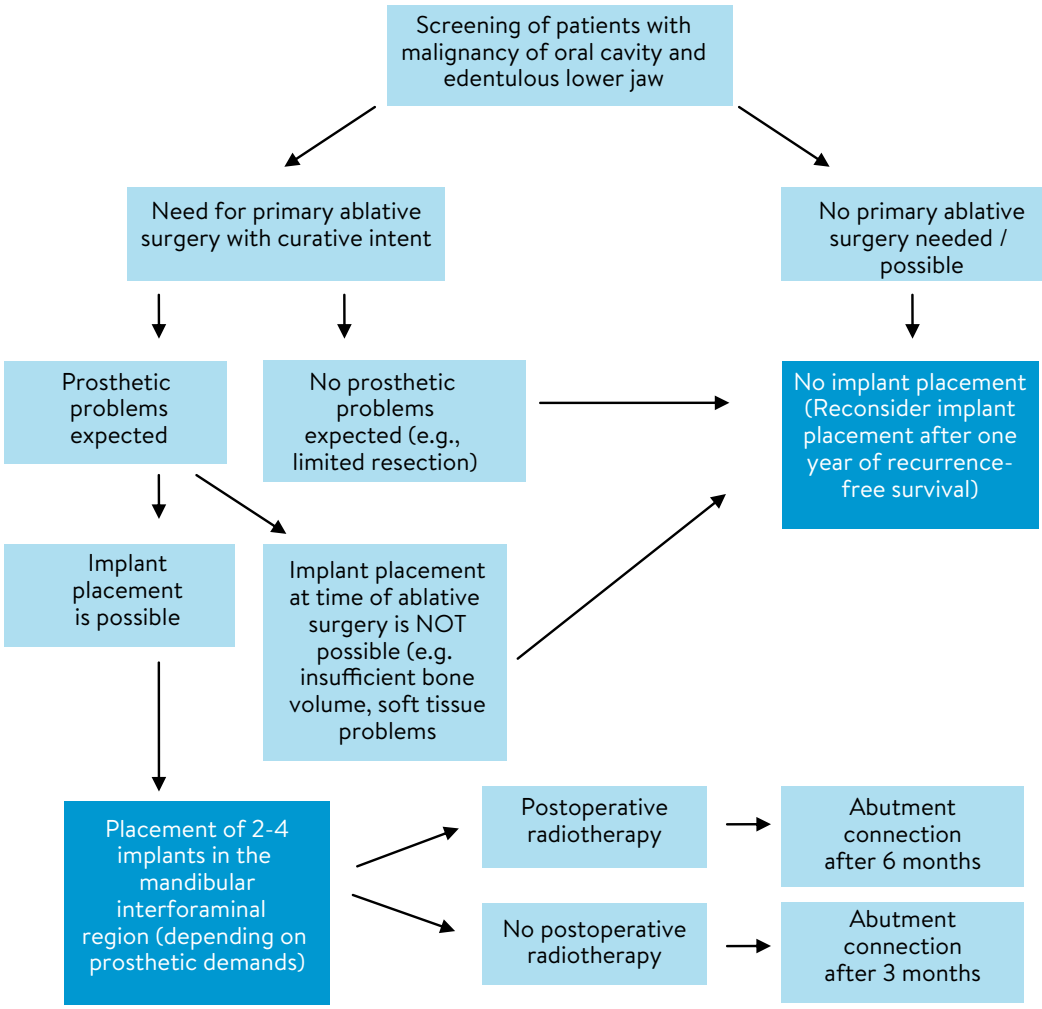
In **chapters 2.1** and **2.2** the results of a prospective 5 year follow-up study on primary inserted mandibular implants in oral cancer patients are described. In this study 50 edentulous oral cancer patients received 4 implants in the mandible during their ablative tumour surgery between 1998 and 2002. Inclusion criteria were: (1) edentulous upper and lower jaw, (2) history of prosthetic problems related to lack of stability and retention of the lower denture, or expected problems with the lower denture after oncological treatment, (3) malignancy in the lower oral cavity or oropharynx which required primary curative resection, and (4) little or no improvement to be expected from making new dentures after oncological treatment. In this study oral functioning, quality of life, condition of peri-implant tissues, implant survival, patients' satisfaction and subjective chewing ability up to 5 years after prosthetic rehabilitation of these 50 patients was assessed. The results 1 year after the prosthetic treatment of these patients had been described previously (Schoen et al. Int J Oral Maxillofac Surg 2008;37:8-16).
Preoperatively, patients had completed validated questionnaires regarding quality of life, oral functioning and patients' satisfaction. The same questionnaires were completed 6 weeks, 1 year and 5 years after completing prosthetic treatment. Also peri-implant indices were assessed at these time points. About two-third of the patients was irradiated postoperatively.
Five years after denture placement, 26 patients were deceased. Four surviving patients did not wear the implant-retained mandibular overdenture for various reasons; meaning 83% of the patients had a functional implant-retained overdenture (n=20). Of these 20 patients, 9 patients had been irradiated postoperatively (45%). Quality of life (QoL) had deteriorated in these 20 patients between 1 and 5 years after placement of the dentures, which was due to the concurrent comorbidity that had occurred in a small number of patients, while global health and QoL for patients without comorbidity was very high. The oral function and denture satisfaction were high too, and did not change over time, comparable to what commonly is observed in healthy patients. At the 5-year follow-up, implant survival rate was 89.4% in irradiated patients and 98.6% in non-irradiated patients (implants as unit).

The mean scores of the peri-implant indices were low at all evaluations, but there was significant bone loss over time in all patients. There were no differences in peri-implant health between the irradiated patients and the non-irradiated patients at all evaluations. Furthermore, overall denture satisfaction was high and did not change over time, both for irradiated and non-irradiated patients. On basis of these results it was concluded that primary implant insertion in this group of patients led to a large number of rehabilitated patients (83%) with favourable long-term treatment outcome.
Based on the favourable results of primary implant insertion as described in chapters 2.1 and 2.2, further study was needed to estimate which patients with oral cancer can benefit from primary implants and how the results of primary implants insertion will be in the long term (see chapter 2.3).

In **chapter 2.3** a study is described assessing the treatment outcomes (which patients benefit, their quality of life, their oral functioning and satisfaction, the condition of the peri-implant tissues, and survival of the implants) of a prospective cohort of 164 patients with oral cancer in the lower oral cavity, who were supplied with primary mandibular implants to support an implant-retained mandibular overdenture up to 14 years after insertion of their implants. The same inclusion criteria and assessments were used as in chapters 2.1 and 2.2, with a few exceptions: the patients were included between 1998 and 2010, and were all reassessed during a final assessment in 2012. Depending on the available bone and the prosthetic demands, 2, 3 or 4 implants were inserted. Also patients not wearing an implant-retained overdenture were asked to complete the questionnaires. Patients in whom prosthetic rehabilitation was completed less than 1 year before assessment were excluded from analysis.
Implant survival in this cohort was lower in irradiated patients compared with non-irradiated patients, viz., 91.5% vs. 99.5%. Five out of 100 irradiated patients developed osteoradionecrosis in proximity to the implants, which could be treated successfully in four out of these five patients. In the fifth patient, a recurrence of the tumour had developed in the same area where the osteoradionecrosis had occurred. Comparable to the results of the study described in chapter 2.2, bone loss around the implants increased significantly over time, both in irradiated and in non-irradiated bone. Again there was no significant difference between irradiated and radiated patients. In 84% of the patients an implant-retained overdenture was made. Completion of prosthetic rehabilitation and oral functioning, chewing ability, and patients' satisfaction were independent of site or stage of tumour, type of reconstruction and the number of implants inserted. Patients wearing an implant-retained mandibular overdenture were able to chew significantly better, had better social function, and had better oral functioning than patients who did not wear an overdenture. Non-irradiated patients had higher scores for satisfaction and oral functioning than irradiated patients.

On basis of the favourable results as reported in chapters 2.1, 2.2 and 2.3, it was concluded that insertion of implants during resection in edentulous patients with oral cancer in the lower oral cavity should be routinely incorporated into surgical planning. To facilitate decision making for implant placement in head neck cancer patients, the algorithm shown in figure 1 is proposed (**chapter 2.4**).

Figure 1. Decision-making process for mandibular implant placement during ablative surgery



Chapter 3 describes the multidisciplinary prosthetic rehabilitation of adult patients after treatment for rhabdomyosarcoma in their childhood. Rhabdomyosarcoma is the most common malignant tumor in the nasal and paranasal sinus area at childhood. The multimodal treatment needed for this disorder (chemotherapy, radiotherapy and

surgery) has severe side effects due to its damaging effects on normal tissue. As a result of this treatment, retardation of facial growth and existence of oral abnormalities such as malformation of teeth and microstomia can cause esthetic and functional problems. Two cases were presented of patients with severe midfacial hypoplasia and reduced oral function as a result of treatment of rhabdomyosarcoma of the nasopharyngeal and nasal–tonsil region. With a combined surgical (osteotomy, distraction osteogenesis, implants) and prosthetic (implant-based overdenture) treatment, esthetics and function were improved.

The use of implants is not restricted to the intraoral rehabilitation of compromised patients. In **chapter 4** aftercare, clinical outcomes of the implants and patients' satisfaction of implant-retained *nasal* prostheses were assessed. This study describes 28 consecutive patients in need of total rhinectomy who were treated according to a standardized protocol with two implants in the nasal floor between 1998 and 2013. Surgical and prosthetic aftercare was scored using patient records. All patients that were alive in 2014 were recalled to assess skin reaction, peri-implant bone loss, and patients' satisfaction. In total 56 implants had been inserted (median follow-up 35.1 months, IQR 8.9-63.3). Implant survival was 96.4%, independent of radiotherapy. Subcutaneous tissue reduction, being the only surgical intervention related to the implants, was performed in 2 out of the 28 patients. With respect to prosthetic aftercare, many patients (65.2%) were in need for (repeated) hygiene instructions and 30.4% of the patients needed (repeated) repair of clips. Median life span of the implant-retained nasal prostheses was 11.6 months (IQR 6.8-15.2). Main reason for prosthesis replacement was discolouration. Peri-implant skin was healthy and patients' satisfaction high with a median of 8.0 out of 10. From the results, it was concluded that rehabilitation of nasal defects resulting from total rhinectomy with implant-retained nasal prostheses according to our protocol resulted in high patient satisfaction and favourable treatment outcome. The average life span of nasal prostheses is limited, mainly due to discoloration of the silicone material.

Not much was known yet about the use of implants in patients with Sjögren's syndrome. In **Chapter 5** clinical outcomes of implant therapy in a cohort of well-classified patients with Sjögren's syndrome is described. The treatment outcome was compared to that observed in matched healthy controls. All Sjögren's patients regularly attending the University Medical Center Groningen for standardized follow-up (n=406) were questioned for earlier oral implant therapy. Patients with implants were recalled to record peri-implant health (using the same indices as described in chapter 2) and implant survival and were compared with data from matched healthy controls. Patients' symptoms, health-related quality of life, oral functioning and satisfaction were assessed using validated questionnaires. Of the responding Sjögren's patients (n= 335), 21% was provided with implants. Data of 50 patients (140 implants) could be collected. Peri-implant health was reasonable, marginal bone loss minor, implant survival was 97% (median follow-up 46 months, IQR 26-73) and

patients' satisfaction was high in most Sjögren's patients. Peri-implant mucositis, defined as bleeding on probing at one or more sites around one or more implants, was higher in Sjögren's patients (94%) than in the healthy controls (71%). There was no difference in prevalence of peri-implantitis between Sjögren's patients and the healthy controls, and also peri-implant health and marginal bone loss were comparable. Furthermore, oral functioning correlated negatively with dryness, patients' satisfaction, and chewing ability in Sjögren's patients. It was concluded that implants are a good treatment option in Sjögren's patients, considering the good peri-implant health, limited prevalence of peri-implantitis, high implant survival and patients' satisfaction.

In the general discussion **(chapter 6)** the results of the previous chapters are placed in a broader context. Based on the results of the various studies described in this thesis it is concluded that patients with a compromised intraoral or extraoral condition benefit largely from rehabilitation with implant-retained prostheses. Implant survival is in general high, peri-implant tissues healthy and patients' satisfaction high.