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Evaluation of Success Parameters of Immediate Loaded Parallel-walled Transgingival Implants

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Introduction

The functional loading of four inter-foraminal placed transgingival FRIALOC® implants with a placement of a bar superstructure directly after surgery is a save treatment, which is based on the experience of the Ledermann concept. Placement of treaded self-cutting implants with a rough surface and reaching a high primary stability at surgery allows to reach osseointegration if a predictable prosthetic procedure stabilize the implants in about one or two days after insertion.

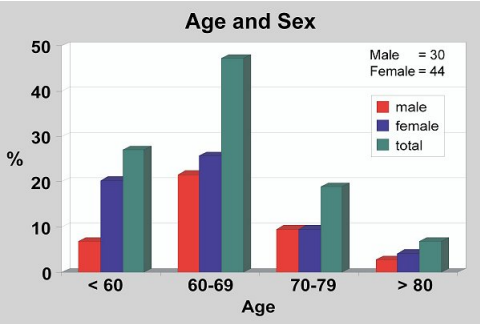
Objectives

The aim of this study was the evaluation of long term results of the treatment concept "immediate loading" in the anterior mandible and the examination of different factors which exert influence on the success. The success parameters were defined to describe the per-implant soft and hard tissue. The relevant factors were number of implants, prosthetic design of implant reconstruction, prosthetic design in maxilla.

Material und Methods

A total number of 321 implants were inserted in 74 patients and were splinted with a bar directly after surgery and restored with an over-denture within 24 hours between 1998 and 2000. Clinical and radio-logical examinations were performed in the following time at least at one of the following time frames:

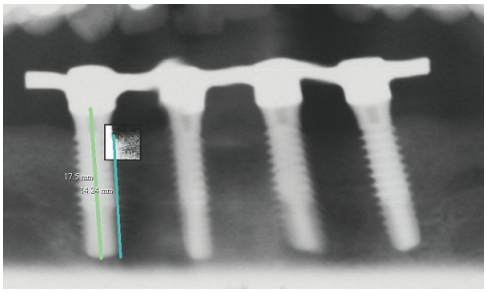
TO	after surgery	(321 implants)
T1	31 up to 90 days	(8 implants)
T2	91 up to 180 days	(56 implants)
T3	181 up to 270 days	(58 implants)
T4	271 up to 360 days	111 implants
T5	more than 360 days	(88 implants)

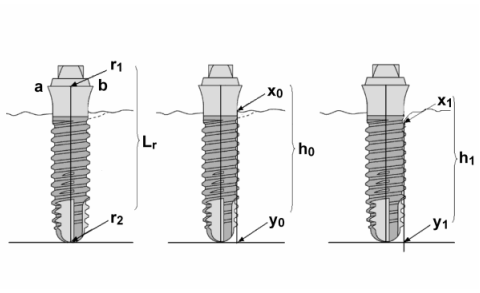


The following parameters were evaluated to determine the peri-implant tissue.

- Vertical bone level (modified acc. Gomez et al.)
- Gingival index (Silness & Löe)
- Bleeding index (GBI, Ainamo & Blay)
- Plaque index (Silness & Löe)
- Probing depth

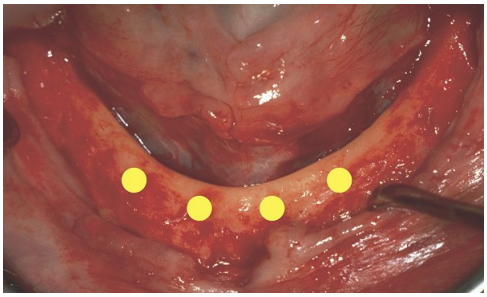
- Failure:
  - Loss of Implant
  - Mobility of Implant
- Risk factors:
  - Age
  - sex
  - Loading time
  - Number of implants
  - Implant diameter
  - Kind of prosthetic treatment of mandible
  - Design of superstructure
  - Kind of prosthetic situation maxilla
  - Recall period



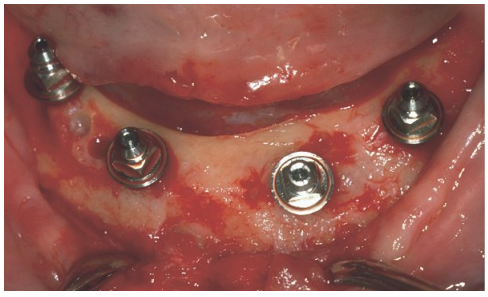


The x-rays were scanned with the FRIACOM system. To compensate the enlargement of the panoramic x-ray the implant length were used as reference and the bone level were determined with modification of the gray scale. The values were generated for the post surgical x-rays and all recall x-rays.

Surgical procedure

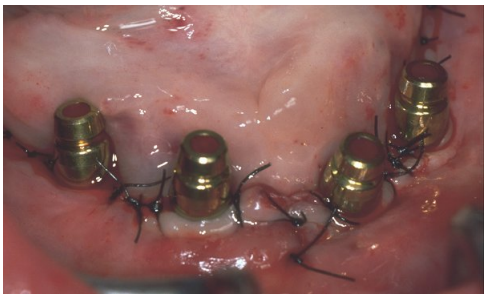


Trapezoid position of four implants for immediate loading. Flap preparation for interforaminal placement of four implants.

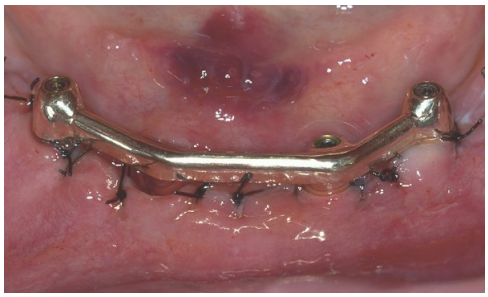


After final placement, the placement screws have to be removed.

Prosthetic procedure

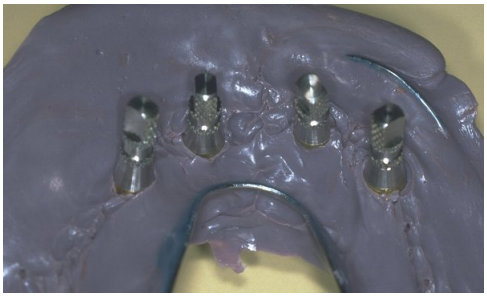


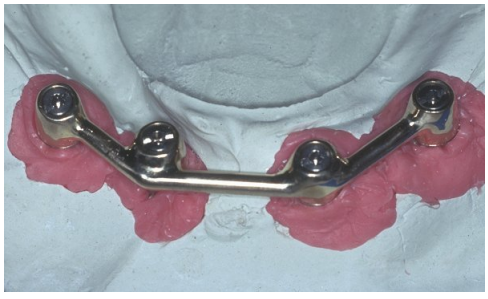
Placement of impression posts directly after implant placement.



Try-in of final bar restoration one day after surgery.

Laboratory procedure

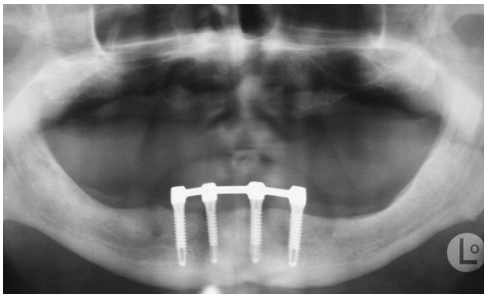




Repositioning of impression posts with implant analog.

Utilizing soldering analogs guarantees a passive fit of the final bar restoration. Polishing is the final step of the bar fabrication.

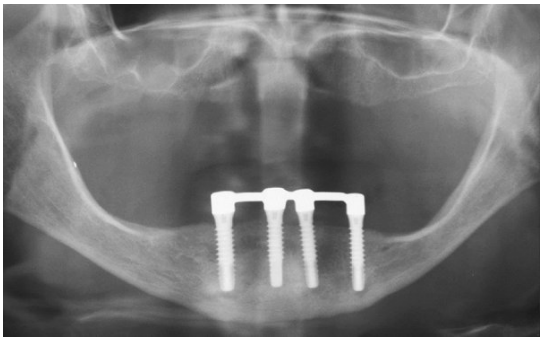
Prosthetic rehabilitation



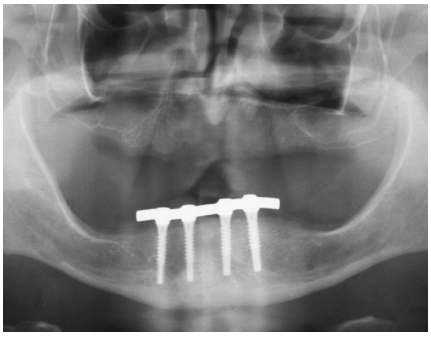
Five months after prosthetic loading with overdenture.

Existing over-denture was modified and clips were placed in resin base.

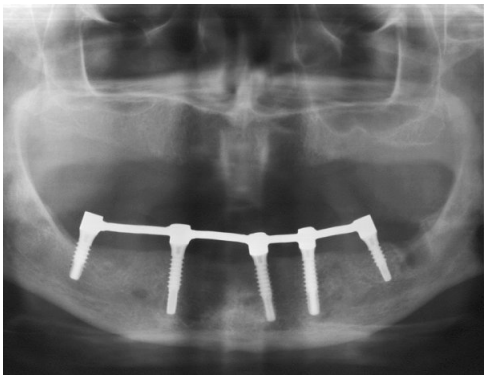
Variation of treatment options



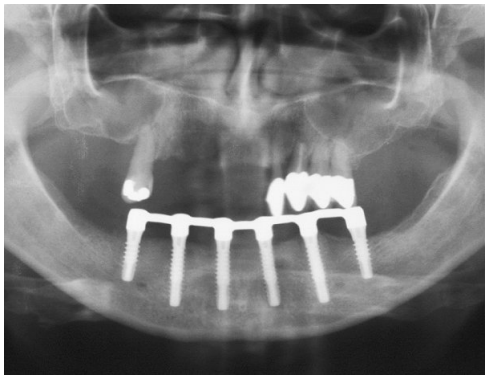
Classical reconstruction with 4 implants without extensions for fixation of over-denture and edentulous mandible.



Reconstruction with 4 implants and parallel milled bar and extensions for the fixation of an over-denture like a removable bridge.

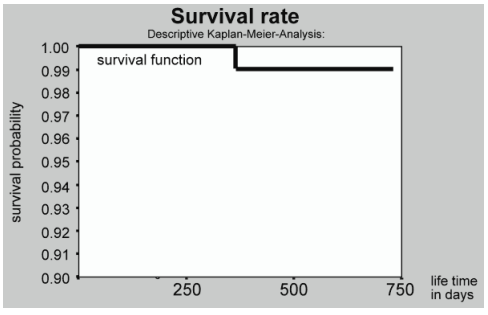


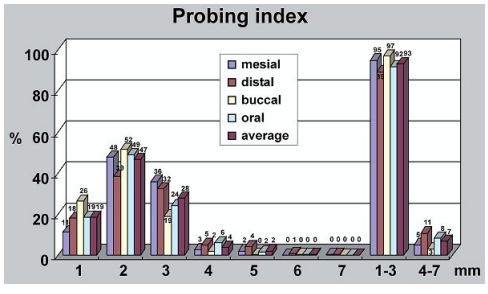
Placement of 3 15 mm implants in the anterior region and 2 short 10 mm implants in the posterior region to reach a deep prosthetic table.



Reconstruction with over-denture and soldered bar on six implants with partial removable denture in the maxilla.

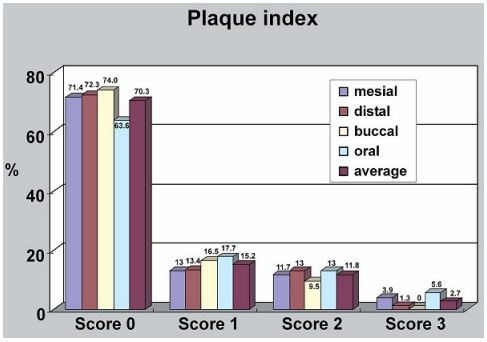
Results



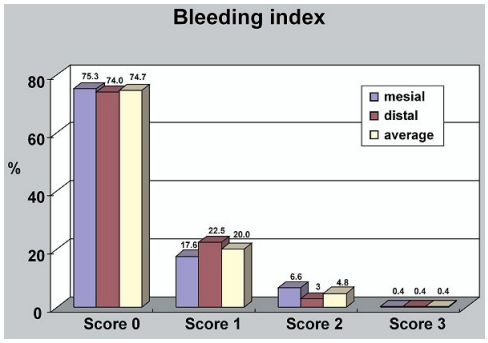


A total 11 implants had to be considered as failures (2 Losses, 10 mobile Implants). The survival rate was 99.03% by a maximum of 659 days of observation period. The success rate was 95.6%.

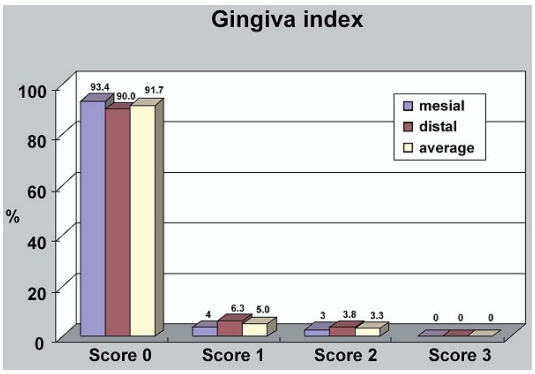
93.2 % of all measured site had a probing depth less than 3 mm. The distal side showed the deepest and the buccal side the lowest values.



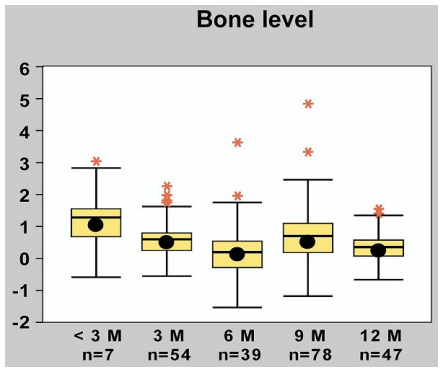
70.3 % of all measured sites showed no plaque accumulation at the recall. Most plaque was found at the oral side.



74.7 % of all measured sites had no bleeding at recall. The distal sites had a little number of more bleeding sites than the mesial ones.



91.7 % Of all measured sites showed no inflammation. The mesial sites showed better values than the distal ones.



After an initial healing period no further bone loss was observed. In average 0.55 mm (mesial 0.58 mm, distal 0.52 mm) was measured. Thereby 20.2 % of the implants showed an increase of bone as result of remodeling of defects at the time of implant placement.

Uni-variant Anova Analysis

Correlation between age and bone level
For the correlation of age the significance was 0.040 for the higher loss of bone level for the younger patients.

Correlation between prosthetic rehabilitation and bone level
A significant higher bone loss level could be found (p = 0.000) if a new denture (n = 71 implants) was incorporated at surgery, than modifying the existing over-denture (n = 126 implants) at the time of implant placement or incorporating a new prosthesis or after three months (n = 28 implants).

Correlation between sex and bone level
For the correlation of sex showed that there is no significant difference 0.106, but a trend for female patients to have a higher loss of bone.

Correlation between prosthetic situation maxilla and bone level
An over-denture in the maxilla (n = 141 implants) has better bone level than an fixed restoration (n = 34 implants) or removable partial denture (n = 50 implants) For the correlation of age the significance was 0.040 for the higher loss of bone level for the younger patients.

Correlation between position and bone level
There was no significant difference (p = 0.272) for implants placed in the inter-foraminal position (n = 194) in comparison to the posterior position (n = 31).

Correlation between diameter and bone level
There was no significant difference (p = 0.126) for different implant diameters, the mean value for D3.5 (n = 39) was 0.7 mm (Stddev. = 0.95 mm), and for D4.0 (n = 186) was 0.5 mm (Stddev = 0.72).

Multi-variant Analysis

The multi-variant model with all relevant factors and the transactions were simultaneously analyzed:

- younger patients have higher bone loss than older
- Female show higher bone loss than male patients
- A new prosthetic over-denture at the time of implant placement leads to higher bone loss than the change of a old reconstruction or new reconstruction after the healing period of three months

- A over- or removable denture in the maxilla causes less bone resorption than a fixed restoration.

According the multi-variant variance analysis the expected bone level can be estimated by adding the likely bone loss for each parameter.
For a 60 to 69 year old female patient with an existing denture in the mandible and a removable denture in the maxilla a bone loss of 0.541+0.329+0.364+0.018-0.689-0.091 = 0.472 mm could be exspected.

Discussion and Conclusions

The collected data show that for the immediate loading of at least four parallel walled trans-gingival implants stable peri-implant parameters can be observed. The success rate of 95.6% for the examined treatment concept is comparable with the findings of delayed loaded implants in this indication. The development of the peri-implant bone loss depends on various factors, which should be considered for the long-term success.

Summary

This survey demonstrate overall healthy peri-implant tissue conditions. More than 90 % of the implants showed no inflammation. The vertical bone loss amounted a mean value of 0.55 mm at the last recall. The acquired survival rate is 99.03% for a maximum observation period of 659 days (median period 10.3 months). A significant correlation between vertical bone loss and age, recall interval, kind of prosthetic restoration could be demon-strated.

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