Implant Prosthodontic Rehabilitation of Patients with Rheumatic Disorders: A Case Series Report

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Purpose: This retrospective study assessed implant and prosthodontic treatment outcomes of patients suffering from rheumatic disorders such as rheumatoid arthritis (RA) and connective tissue diseases (CTDs). ***Materials and Methods****:* This study included 22 patients (all women) suffering from autoimmune rheumatic disorders such as isolated RA (n = 16), RA with concomitant CTDs (n = 5), or isolated CTDs (n = 1). Overall, 89 implants were placed for rehabilitations such as single-tooth replacement (n = 8), fixed partial dentures (n = 14), complete dentures (n = 5), and overdentures (n = 2), and were evaluated after a mean of 42.6 ± 25.2 months. The cumulative implant survival and success rates and peri-implant conditions (marginal bone loss, pocket depth, Plaque Index, Gingival Index, Bleeding Index, and Calculus Index) were evaluated with a special focus on RA and CTDs. In addition, incidence and type of prosthodontic maintenance were evaluated. ***Results:*** A high implant survival rate was noted during follow-up with a cumulative 3-year implant success rate of 96.1%. Patients with RA demonstrated acceptable marginal bone resorption (mean: 2.1 ± 0.5 mm) and good soft tissue conditions, while CTD patients showed increased bone resorption (mean: 3.1 ± 0.7 mm). This was especially noted in scleroderma patients, as were major peri-implant soft tissue alterations (Bleeding Index) in patients suffering from Sjögren syndrome. ***Conclusions:*** A high implant and prothodontic success rate can be anticipated even for patients suffering from autoimmune rheumatic disorders such as RA and CTDs. A scrupulous maintenance program that includes optimal oral hygiene could assist in ensuring stable long-term results for CTD patients with more vulnerable soft tissue conditions. *Int J Prosthodont 2010;23:22–28.*

Long-term maintenance of the implant-bone interface requires continuous bone remodeling and is determined by a complex tissue response.[1,2] Osseointegration and maintenance of endosseous dental implants are influenced by many factors and dependent on specific systemic or local oral conditions.[3–7] Frequently, patients with various rare diseases are considered to be at an increased risk of implant failure and excluded from dental implant therapy.[4,5] Because systemic diseases may affect oral tissue, increase susceptibility for other disorders, or interfere with healing, implant placement is often considered as being contraindicated for such patients.[3–7] Today, it has been clearly shown that failure of osseointegration is multifactorial and dependent on anatomical conditions, systemic health, genetic disposition, immune function, and behavioral factors.[3,8,9]

Patients requiring special care as a result of rare systemic disease are those suffering from autoimmune diseases affecting the bone and soft tissue structures.[4,5] Thus, patients with rheumatoid arthritis (RA) and chronic connective tissue diseases (CTDs) represent a population with autoimmune diseases affecting the soft and hard tissue structures and are of major interest for oral medicine and especially dental implantology.[6,7,10–17] It is well known that RA represents a chronic inflammatory disease ultimately leading to arthritis, bursitis,

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and tendovaginitis as a result of synovitis.[10,12–15] The disease shows a progressive but intermittent course leading to joint destruction and is frequently accompanied by osteoporosis due to increased systemic bone turnover and anti-inflammatory or combined antiimmune treatment regimes.[12,13] Clinically, hematology shows a marked increase of nonspecific inflammatory parameters and elevation of positive rheumatoid factors in 75% of cases.[15,16,18]

CTDs such as Sjögren syndrome or scleroderma may develop in conjunction with RA or as separate disease entities.[10,11,16–18] However, since RA and CTDs show similarities in clinical symptoms, diagnosis, and pathomechanism (positive rheumatoid factors, inflammatory markers, autoimmune genesis), and since similar treatment modalities have been traditionally used, both diseases may be generally summarized and categorized as rheumatic disorders.[15–23]

Available literature includes only a few comprehensive studies or case reports with data regarding special care patients and the beneficial effects of implant prosthodontics in oral rehabilitation.[4–6] Few authors have reported on the evident clinical improvement of oral mucosal complaints after implant placement and prosthodontic rehabilitation in patients with CTDs such as Sjögren syndrome or scleroderma.[24–27] In a recent study by Oczakir et al,[5] implant prosthodontic rehabilitation in patients with several rare diseases was described in detail but without a particular focus on patients with RA. In general, there is a lack of reports on patients with RA (with or without concomitant CTDs) and their outcomes after undergoing implant treatment procedures for prosthodontic rehabilitation.

The purpose of this study was to evaluate the impact of systemic autoimmune bone and soft tissue disease, such as RA and CTDs, on the survival and success rates of osseointegrated implants. The analysis was focused on demonstrating that both disease entities should not generally be considered as an absolute contraindication for dental implant placement.

Materials and Methods

Patient and Implant Selection

In this retrospective clinical follow-up study, a series of patients with specific medical conditions were recruited. All patients had received submerged implants between March 2001 and June 2007 for implant-based prosthodontic rehabilitation, and the study population comprised 22 patients suffering from autoimmune diseases such as RA (n = 16) or CTDs (n = 6). The included patients were part a 561-patient population who received implant treatment during this time period. According to patients' charts, the included study population presented all patients suffering from the target conditions (RA or CTDs).

Diagnosis of RA was based on the criteria of the American Rheumatism Association and were fulfilled by 21 patients.[10,11] CTDs were diagnosed either as a concomitant disease together with RA (n = 5) or as an isolated disease entity (n = 1). Rheumatoid factors (positive in 19 of 22 patients), antinuclear antibodies (positive in all 6 CTD patients), and C-reactive protein along with other inflammatory markers provided specific diagnostic markers for both autoimmune disorders and are listed in Table 1.[10,15.19–23]

Clinical presentation of CTD varied between Sjögren syndrome, dermatomyositis, and scleroderma, and was also diagnosed by clearly defined general medical criteria.[11,16–23] All patients received basic therapeutic treatment (current or previous use of corticosteroids) in conjunction with acute or previous treatment with NSAIDs (diclofenac, ibuprofen) or immunosuppressants (methotrexate). No patient received any type of bisphosphonate therapy. Similarities in clinical signs, diagnosis, pathologic mechanisms, and treatment regimes led the authors to summarize both types of autoimmune diseases in a comprehensive group classified as rheumatic disorders.[10,15]

All patients (22 women, age: 55.6 ± 7.9 years) underwent implant surgery and prosthodontic treatment and were treated with screw-designed dental implants (Camlog Biotechnologies) placed, restored, or removed by clinicians. A total of 89 implants of differing lengths and diameters were placed with varying indications for different stages of edentulism, ranging from single-tooth gaps to complete edentulism. All subjects were invited to participate in a follow-up examination carried out by clinicians in the same dentist office as implant placement, restoration, or removal. The study was approved by the local ethics committee and all participants provided written informed consent.

Prosthetic Treatment

Prosthetic treatment was performed 2 to 4 weeks after implant exposure. Implants (n = 89) were used for restoration of single teeth, overdenture treatment, fixed partial dentures, and complete fixed dentures (Table 1). Single-tooth crowns and fixed partial prostheses were either metal-ceramic (gold alloy, titanium) or full ceramic; complete dentures were fabricated of either acrylic resin with a metal framework or metal-ceramic design. The mandibular overdentures were supported by bar retention on two implants; the maxillary overdentures were supported by milled bars stabilized on six implants. Both overdentures were fabricated with metal-reinforced frameworks.

Table 1 Patient Characteristics

Patient no.	RA	CTD	Rh-factor	C-protein	ANA	Implants	Prosthesis	Duration of wear (mo)	Therapy type
1	Yes	SJ	+	Yes	Yes	6 maxilla	OD	91	Ap, Cf
2	Yes		+	Yes		2 mandible	OD	88	Ap
3	Yes		+	Yes		4 mandible	CD	66	Ap, Cf
4	No	SK	+	Yes	Yes	6 mandible	CD	46	Ap, Cp
5	Yes	DM	+	Yes	Yes	2 maxilla	FPD	22	–
6	Yes		+	Yes		5 maxilla	FPD	38	Af, If
						2 mandible	S (2)	42	
7	Yes	SJ	+	Yes	Yes	3 maxilla	FPD	46	Ap, Cf
8	Yes		+	Yes		2 mandible	FPD	90	Ap, If
9	Yes		+	Yes		4 mandible	OD	28	Ap, IP, Cpf, I
10	Yes		+	Yes		1 mandible	S	16	
11	Yes		–	Yes		3 maxilla	FPD	32	Ap, Cf
						2 mandible	FPD	28	Af, Cf
12	Yes		–	Yes		2 mandible	S	34	Af
						1 maxilla	S	14	
13	Yes		+	Yes		4 maxilla	FPD (2)	37	Af
14	Yes		+	Yes		4 maxilla	FPD	45	Ap, Cf
15	Yes	SJ	+	Yes	Yes	4 maxilla	FPD	48	Ip, Cf, Af
16	Yes		+	Yes		3 maxilla	FPD	54	
						5 mandible	FPD (2)	62	Ap
17	Yes	SJ	+	Yes	Yes	8 mandible	CD	42	Ap
18	Yes		+	Yes		4 maxilla	CD	56	–
19	Yes		–	Yes		4 mandible	CD	58	Ap, Cp
20	Yes		+	Yes		2 mandible	FPD	36	Ip, Ap
21	Yes		+	Yes		4 maxilla	FPD	28	Ap, Cf
22	Yes		+	Yes		2 mandible	S (2)	62	Cp

RA = rheumatoid arthritis; CTD = connective tissue disease; ANA = antinuclear antibodies; SJ = Sjögren syndrome; SK = scleroderma; DM = dermatomyositis; OD = overdenture; CD = complete denture; FPD = fixed partial denture; S = single implant; A = analgetica/antipholgistica; C = corticosteroid; I = immunsuppressiva; p = present use; f = former use.

Implant and Prosthodontic Follow-up Examination

All patients included were part of a regular recall program and were placed in a strict follow-up program and initially evaluated at intervals of 6 months for the first year. Thereafter, they were evaluated annually. The recall program included assessments of peri-implant marginal bone loss (mm) in implants initially placed at the crestal level; pocket depth (mm); Plaque Index, Gingival Index, and Bleeding Index (grade 0 to 3); as well as calculus status (0 to 1), in addition to implant survival time (months), as described in previous studies.[28,29]

Marginal bone resorption was assessed radiographically. The radiographic evaluation included an orthopantomogram and single periapical radiographs based on the paralleling technique, where the reduction of the bone height level was determined in relation to the implant shoulder. For this purpose, the initial postoperative radiograph (baseline) was compared with the most recent one to calculate implant crestal bone level and the effective marginal bone loss as the result of the difference.[30]

Peri-implant pocket depth was measured using a calibrated periodontal probe (Hu-Friedy) on the mesial, distal, lingual, and buccal sides of the implant.

During the follow-up period, prosthodontic complications and repairs for the implant-supported restorations were registered according to following events (modified from Payne and Solomons[31]):

- Implant component maintenance: implant loss or fracture; abutment screw loosening; screw, abutment, or bar fracture
- Prosthesis (denture) component maintenance: crown or fixed partial denture loosening (cement failure [temporary cementation with TempBond, Kerr]), ceramic fracture, matrix activation or renewal, overdenture teeth fracture or renewal, overdenture fracture, denture margin adaptation (reduction or relining), overdenture rebased, opposing prosthesis maintenance (fracture, rebased, or remade)
- Soft tissue complications: incidence of recession, fistulae, and mucosal enlargement assessment

Concerning the implant outcome, cumulative survival and success rates were calculated for individual implants by means of life table analysis. Implants still in function (survived) were further evaluated using additional success criteria.[32] These criteria were as follows: *(1)* absence of persistent complaints such as pain and dysesthesia, *(2)* absence of recurrent peri-

Table 2 Implant Characteristics

	Diameter			
Length	3.8 mm (%)	4.3 mm (%)	5.0 mm (%)	Total
11 mm	-	1 (1.1)	2 (2.2)	3
13 mm	9 (10.1)	15 (16.8)	7 (7.9)	31
16 mm	34 (38.2)	11 (12.4)	10 (11.2)	55
Total	43 (48.3)	27 (30.3)	19 (21.3)	89

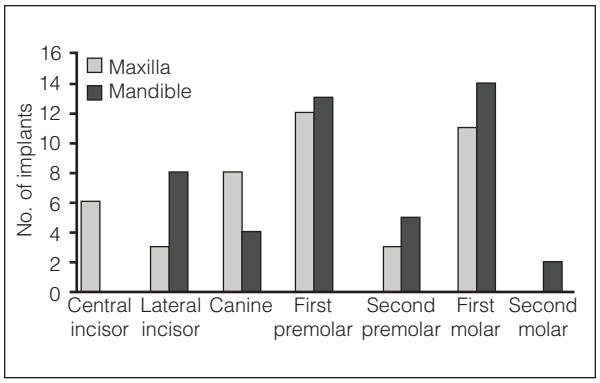

Fig 1 *(right)* Detailed distribution of the 89 loaded implants (46 mandibular, 43 maxillary) in patients suffering from autoimmune diseases.

Table 3 Life Table Analysis of Implants Placed

Interval	Implants	Not in time	Failures	Dropouts	CScR (%)
PI-loading	89	0	0	0	100
PI-1 y	89	0	0	0	100
PI-2 y	85	4	0	0	100
PI-3 y	68	15	2	0	97.1
PI-4 y	32	35	1	0	96.1
PI-5 y	21	11	0	0	96.1
PI > 5 y	21	0	0	0	96.1

CScR = cumulative siccess rate; PI = implant placement.

Table 4 Peri-implant Parameters of All Implants at the Follow-up Examination

	Total (n = 89)	RA (n = 60)	CTD (n = 29)
Bone loss (mm)	2.4 ± 0.6	2.1 ± 0.5	3.1 ± 0.7
Probing depth (mm)	3.6 ± 1.3	2.8 ± 2.0	3.2 ± 2.1
Plaque Index (0-3)	0.7 ± 0.4	0.5 ± 0.5	0.5 ± 0.7
Gingival Index (0-3)	0.5 ± 0.4	0.3 ± 0.5	0.3 ± 0.5
Bleeding Index (0-3)	0.7 ± 0.4	0.5 ± 0.3	0.9 ± 0.8
Calculus Index (0-1)	0.4 ± 0.5	0.4 ± 0.4	0.5 ± 0.5

RA = rheumatoid arthritis; CTD = connective tissue disease.

implant infection with suppuration, *(3)* absence of mobility, *(4)* absence of peri-implant radiolucency around the implant, and *(5)* absence of a mesial or distal vertical bone loss of more than 3/10 of the implant's length.

Statistical Analysis

Parameters were recorded in a descriptive statistical manner, tabulated, and evaluated. Mean values were compared using the Student *t* test; nonparametric data were evaluated using the chi-square test. Statistical significance was set at $P < .05$.

Results

Implant Survival and Success Rates

Eighty-nine implants were placed in 22 patients and were available for follow-up examination. As a result of the strict recall procedure, no permanent dropouts were encountered, though temporary dropouts were seen for the annual check-up for various reasons (cerebral stroke, accident, sickness).

Table 1 summarizes the patient characteristics, including the specific autoimmune disease and the type of implant prosthodontic restoration, with single-tooth (n = 7), fixed partial denture (n = 15), overdenture (n = 3), or complete denture (n = 5) being evaluated. Sixty (67.4%) implants were placed in RA patients and 29 (32.6%) were placed in patients with CTDs. Previous or present medical therapy has also been listed. Detailed implant characteristics with lengths and diameters used for the prosthodontic rehabilitation are presented in Table 2.

Figure 1 shows a detailed distribution of the 89 loaded implants (46 in the mandible, 43 in the maxilla). At the time of data collection, all implants had been in situ for 46.1 ± 20.8 months (range: 1 to 7 years), representing a cumulative implant survival rate of 100% (no loss). However, regarding the previously defined success criteria, 3 implants showed increased pericrestal bone resorption and were classified as failures. Thus, the cumulative success rate decreased to 96.1%, as shown in Table 3.

Peri-implant Parameters and Prosthodontic Maintenance

Table 4 provides the peri-implant parameters at the most recent examination for RA and CTDs. When comparing the two, a higher, though not significant, extent of marginal bone reduction and a higher Bleeding Index were noted in patients with CTDs.

Table 5 Type of Implant Prosthodontic Maintenance and Complications

Implant component maintenance	
Implant fracture	0
Abutment screw loosening	2
Abutment fracture	0
Implant-bar fracture	0
Prosthodontic component maintenance	
Crown/FPD loosening	2
Prosthesis teeth fracture	6
Acrylic resin/porcelain teeth	4/2
Denture matrix activation/renewed	0
Denture margin adaption (reduction/relined)	2
Opposing prosthesis rebased/remade	0
Soft tissue complaints	
Recession	2

FPD = fixed partial denture.

The follow-up revealed that all prostheses were maintained without any major revision (remakes or significant changes). During the follow-up period, a total of 12 postinsertion interventions for the implant and prosthodontic components were noticed. Implant component maintenance included only abutment screw loosening (1 single-tooth restoration and 1 fixed partial denture), but no implant, abutment, or bar fracture. The most common postinsertion maintenance of the prosthesis component for the fixed or removable restorations was repair of fractured prosthesis teeth without any predominance of denture type (6 instances: 4 acrylic resin teeth and 2 porcelain). The detailed distribution of evaluated postinsertion aftercare is shown in Table 5.

Discussion

Patients suffering from RA with or without concomitant corticosteroid treatment will develop localized osteopenia and generalized osteoporosis in 30% to 50% of cases.[13,33,34] Osteoporosis induced by various pathogenic factors may be associated with a higher risk of bone facture and prolonged healing periods following bone surgery.[33-37] RA-associated bone loss and osteoporosis may develop very early and correlate directly with disease activity, and also be associated with a negative impact on patient mobility at later stages.[12–15,36–39] Moreover, administration of corticosteroids or development of other endocrinopathies may induce or promote osteoporosis.[40,41] As pathogenetic cofactors, corticosteroids will reduce intestinal calcium absorption and increase renal calcium excretion, resulting in a compensatory increase of the release of parathyroid hormone and increased sensitivity of bone to it. As reported by Nakayama,[33] bone of RA patients is likely to show a higher turnover, thus confirming the studies of Haugeberg et al[12] and Haugeberg,[13] who were able to demonstrate that RA patients show a twofold prevalence of osteoporosis.

Although the relationship between skeletal and jaw bone mass is limited,[42] implant outcome has frequently been a topic of clinical interest for studies on patients with different types of induced osteoporosis.[2–6,43–46] However, acceptably high implant success rates for patients with osteoporosis induced by either postmenopausal hormone deficiency or corticosteroid use have been described by Friberg[46] and van Steenberghe et al.[3,7] In previous studies by Dao et al[44] and more recently by Holahan et al,[45] only minor evidence for an association of osteoporosis of different causes and dental implant failure has been reported. The results of the present investigations confirm that RA, which may be associated with osteoporosis, does not constitute a contraindication for implant therapy and was not associated with a higher implant loss rate than that seen for a healthy population without RA. As a limiting factor for the results obtained in the present study, it must be pointed out that the degree of osteoporosis in the RA patient population studied was not determined in detail using measurements with the dual-energy x-ray absorptiometry technique.[42] However, additional information obtained on the current or previous use of corticosteroids and immunosuppressant medication may be helpful in establishing a clinical diagnosis of reduced bone quality.[4,42] Therefore, the authors agree with the statement of Mombelli and Cionca[4] that visual assessment of bone quality at a site considered for implantation may be more informative than bone mineral density measurements obtained from the peripheral bone.

The use of a traditional healing period (3 to 6 months), even for dental implants with surfaces showing accelerated osseointegration (SLA),[47,48] as recommended by Friberg[46] for soft bone quality, resulted in high absolute success and survival rates for implants placed in RA patients.[3–7,46] In addition, detailed information on patients at risk for implant failure regarding their underlying disease will provide patients with greater motivation to comply with a regular recall and maintenance program. In this respect, aftercare was highly successful and helpful in establishing and ensuring an optimal implant outcome, including acceptable data of peri-implant parameters and implant prosthodontic results.[49] The exclusive presence of female patients also confirms the general prevalence of RA and CTDs, and provides for a patient population being well informed about their disease.[3,5,26]

Because of numerous similarities in clinical signs, diagnosis, pathogenesis, and therapeutic regimens for RA and CTDs, a summary approach for both disease entities was initially advocated.[18–23] Presentation of

some patients with RA and CTDs as comorbidities may justify this approach.[3–7,15,22–27] The results of this study showed that the implant prosthodontic outcome was excellent for patients with various CTDs. Clinical benefits and advantages of implant placement in conjunction with fixed prostheses were especially noted in patients suffering from CTDs such as scleroderma and Sjögren syndrome, which predominantly affect the oral mucosa and consequently, the mucosal denture support.[24–27] The problem of soreness in the oral mucosa in conjunction with removable mucosa-supported prostheses and dry mouth sensation is well known and may constitute a particular problem for elderly patients that might be avoided or reduced by the exclusive implant support of dentures.[25,26] As described by Binon[24] and Isidor et al,[26] the clinical benefits of purely implant-supported dentures was evident for patients with Sjögren syndrome. Because all prostheses used for this population with various types of autoimmune diseases were manufactured for solely implant support (fixed partial denture or maxillary overdenture with milled bars; Table 1), no denture was found to interfere with the vulnerable mucosa.

However, with regard to the peri-implant structures (keeping in mind that gingival responses and bony ones are not identical), slight differences were observed between RA and CTDs. First, there was evidence that pericrestal bone resorption was more pronounced for implants placed in patients with scleroderma and Sjögren syndrome. This may be explained by the pathogenesis of the underlying disease with a decrease of mucosal vascularization and a consequent reduction of bone nutrition, which may also reflect a tissue reduction.[50–53] Second, although hygiene parameters were acceptable as a result of the strict recall cleaning program, patients with CTDs showed a higher Bleeding Index than patients suffering from RA without concomitant CTDs. Vulnerability of the soft tissue as a result of vascular involvement of the immune pathogenesis of the connective tissue may play a critical role in this pathomechanism.[51–53]

In general, no atypical pattern of prosthodontic complications and maintenance efforts was observed for implants and implant prosthodontics in RA patients with or without concomitant CTDs. Only abutment screw loosening or denture margin adaptation for overdentures were predominantly noticed. Most of the implant prosthodontic rehabilitation was done with fixed prostheses to avoid trauma to the soft tissue and to keep prosthodontic maintenance to a minimum.[14,26] It should also be mentioned that although manual dexterity is often reduced in RA patients,[54,55] this phenomenon did not appear to adversely affect the peri-implant or prosthodontic parameters of aftercare.[49,56,57]

Due to the fact that this study included a relatively short duration of observation as well as age and sex considerations and lacks comparison with a similar patient group in terms of age, sex, and treated sites, the only trend in this special patient population that can be reported is the treatment—fixed implant prosthodontics. Nevertheless, it seems reasonable to suggest that the use of screw-type dental implants for patients with specific autoimmune diseases can be successfully prescribed with the proviso that regular professional support for optimal aftercare is followed.

Conclusion

On the basis of this retrospective clinical review, the following was observed:

- The clinical outcome of dental implant placement and implant prosthodontic rehabilitation was not negatively influenced in patients with autoimmune diseases such as RA or various types of CTDs.
- Patients suffering from CTDs presented marked peri-implant crestal bone resorption, as well as a higher Bleeding Index, than patients suffering from RA.

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