

Organ Transplantation – Assessment of Dental Procedures

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Purpose: Organ transplantation is now an established therapeutic strategy for treating many end-stage organ diseases and dysfunctions. The obligatory lifetime immunosuppressive therapy, which is necessary to prevent graft failure, predisposes the patient to infection. Because the oral cavity represents an important port of entry for systemic infections, a comprehensive clinical and radiographic oral examination and dental management of patients prior to transplantation will ensure the elimination of any active infection and minimize the possibility of infection after the transplantation. The aim of this retrospective study was to evaluate the significance of dental management prior to organ transplantation and to determine its relationship with graft rejection, morbidity and mortality of the patients.

Materials and Methods: A total of 102 patients (67 men, 35 women, median age: 42.8 years) who had undergone an organ transplantation were studied. 58 patients received allogeneic or autologous stem cell transplantation (SCT) and 44 patients had undergone liver (LTx) or heart (HTx) transplantation. Seventy of these received dental treatment prior to surgery. Lack of time and the individual health condition of the other 32 patients made possible only the initiation or reinforcement of a preventive dental and oral hygiene program. Prior to any invasive procedures screening laboratory tests were performed in order to reveal the coagulation status; additionally the need for antibiotic coverage was always discussed with the transplant surgeon.

Results: Postoperative complications such as infections, rejection of the transplant, GvHD, relapse of the malignancy and oral mucositis occurred in 80% of the patients who had undergone organ transplantation without dental interventions and only in 45.8% of the patients with completed dental treatment. Statistical analysis of data showed significant correlations ($p < 0,05$), between complications and semi-impacted or impacted teeth making obvious the need for dental management before transplant surgery. A causative relationship between dental foci and life-threatening infections, graft rejection, morbidity and mortality could not be established in our study, a fact, which is probably the result of the great advances in immunosuppressive therapy.

Conclusions: Thus, it can be concluded that the dental concept prior to SCT, LTx and HTx does not have to be a radical one. Further research should clarify the causative association between oral and dental foci and the transplantation outcome.

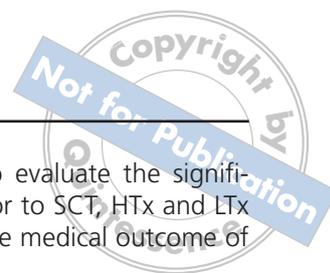
Key words: dental focus, organ transplantation, dental evaluation, dental treatment.

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INTRODUCTION

Organ transplantation is nowadays an important and successful treatment method, which requires the highest standards of services in the medical field. The great

advances in surgery, in tissue-matching techniques and in immunosuppressive therapy have established the transplantation of kidneys, liver, heart and stem cells as an accepted clinical modality (Pichlmayr, 1989; Seymour et al, 1997; Groth et al, 2000). The number of transplanta-



tions performed in the year 2003 in U.S.A. was 25.463, while in December 2004 there were 93.635 registered candidates on the waiting list (UNOS-homepage).

Data for the European countries showed that in 2004 almost 5.304 transplantations were performed and that there were approximately 15.865 candidates waiting for a transplant (Eurotransplant homepage).

Allogeneic stem cell transplantation (SCT) has become an essential part in the treatment of many malignant and non-malignant hematological diseases, including acute and chronic leukemias, aplastic anemia, myelodysplastic syndromes, severe combined immunodeficiency, lymphomas and selected solid tumors (Margolis et al, 2000; Secola, 2001; Storb and Buckner, 1990).

The indications for a liver transplantation (LTx) include end-stage liver diseases, post-hepatic cirrhosis, chronic active hepatitis, extrahepatic biliary atresia in children, primary biliary cirrhosis, malignant tumors, Budd-Chiari-syndrome, sclerosing cholangitis and alcohol-related cirrhosis and hepatitis (Little and Rhodus, 1992). The 1-year survival rate after orthotopic LTx is established at 75-80%, while patients who survived the first posttransplant year had actuarial 5- and 10-year survival rates of 92% and 84%, respectively (Busuttil et al, 1994; Douglas et al, 1998). At Charité, Campus Virchow-Klinikum, University Medicine Berlin, the survival rates 1-, 5- and 10- years after LTx are 92%, 89% and 75-78% respectively (Neuhaus, 2004).

Orthotopic heart transplantation (HTx) is used to treat terminal myocardial disease that cannot be corrected by other medical or surgical therapy. Major recipient diseases include idiopathic cardiomyopathy (50%), ischemic cardiomyopathy (40%), end-stage valvular disease (5%), and miscellaneous causes (5%) (Harms and Bronny, 1986). The most common indications for HTx are dilated cardiomyopathy and end-stage heart failure (Hetzer et al, 1985).

Odontogenic inflammation may favor transplant rejection, cause bacterial, viral or fungal infections, and lead to life-threatening postoperative infections. Optimum transplantation management involves appropriate patient selection, thorough pretreatment dental evaluation, prompt management of complications during immunosuppression, and regular posttransplantation follow-up (Boraz, 1986; Eigner et al, 1986; Bergmann, 1988; Lazarchik et al, 1995; Klempnauer, 1997; Einsele and Kanz, 1999; Folwaczny and Hickel, 2001; Akintoye et al, 2002; Waltimo et al, 2005).

To reduce morbidity, dental evaluation for identification prior to organ transplantation (pre-Tx) and necessary treatment to eliminate all sources of potential infections has become standard care for the patients being prepared for SCT, HTx or LTx.

The aim of this study was to evaluate the significance of dental management prior to SCT, HTx and LTx and to determine its effects on the medical outcome of the transplantation.

MATERIALS AND METHODS

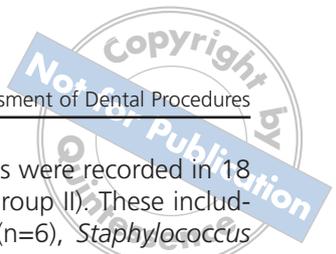
A retrospective study was carried out in 102 patients (67 men, 35 women, median age: 42.8 years; s.d.: 12.7 years) who had undergone organ transplantation at the transplant units of Campus Virchow, Medical University-Berlin (Charité) and at the German Heart Centre in Berlin, Germany. Fifty-eight patients received allogeneic or autologous stem cell transplantation (SCT), 23 patients had undergone liver (LTx) and 21 heart (HTx) transplantation.

The dental status of all patients was evaluated pre-Tx by two experienced dentists of the department of Oral Surgery and Dental Radiology at the same university campus. Screening examination consisted of clinical examination of the hard and soft oral tissues and a radiographic survey including panoramic and occasional periapical films for symptomatic teeth. Dental foci were defined as marginal or periapical infected teeth and semi-impacted teeth (Meyer et al, 1999; German Society of Dental Oral and Craniomandibular Sciences (DGZMK) 1999; Majorana et al, 2000).

The dental treatment protocol pre-Tx was a less radical one, which included restoration of all active carious lesions, extraction of all nonrestorable teeth and of those with advanced periodontal disease. Nonvital teeth were treated endodontically or extracted, whereas apical lesions were treated by root canal fillings, apicoectomy or extraction.

Medical consultation with the responsible hematologist was always conducted before any invasive dental procedures to establish the degree of immunosuppression, the ability of the patient to tolerate dental treatment, and the need for antibiotic coverage to prevent oral and generalized infections, according to the recommendations of the American Heart Association (Dajani et al, 1997). Additionally, screening laboratory tests (complete blood and platelet count, prothrombin time, and partial thromboplastin time, or international normalized ratio) were performed to determine the coagulation status and avoid the risk of severe hemorrhage.

Patients were divided into two groups: those who had no dental foci or completed dental treatment pre-Tx (n=70, group I) and those with dental foci who underwent Tx without any dental interventions (n=32, group II). Shortage of time before the transplantation and the poor general condition of these 32 patients allowed only for initiation or reinforcement of a preventive oral hygiene program.



Inspection of the oral mucosa of the patients revealed denture stomatitis in 3 cases and plicated tongue in one case. An intraoral fistula was diagnosed in one case. The other pathological findings pre-Tx are summarized in Table 1 and the form of dental treatment pre-Tx, which was carried out, is shown in Table 2.

The data documentation after organ transplantation (post-Tx) was carried out by reviewing the patients' medical records for an average of 50.5 weeks (range: 25,7- 75,2 weeks) after the transplantation date.

Statistical analysis using the Pearson's χ^2 -test was performed to evaluate the effect of dental foci on posttransplantation outcome; the level of significance was set at $P < 0.05$. Univariate analysis of various parameters was tested by Spearman's correlation analysis and the Kolmogorov-Smirnov-test and Q-Q-Plot were used to check the normal distribution of the values. For statistical analyses the statistical software program SPSS for Windows, version 10.0 was used (SPSS, Chicago, Ill., USA).

RESULTS

Post-Tx complications were recorded in 45.8% of the patients of group I, whereas in group II the percentage of complications reached the level of 80% (Fig 1).

A total of 21 post-Tx infections were recorded in 18 patients (10 in group I and 8 in group II). These included cytomegalovirus reactivation ($n=6$), *Staphylococcus epidermis* bacteremia ($n=5$), *Pneumocystis carinii*-pneumonia ($n=3$), invasive fungal infections of the lungs ($n=4$), and one case each of infection with herpes simplex virus, *Candida albicans*, and *Escherichia coli* (bacteremia).

A rejection of transplant was recorded in four cases (2 in group I and 2 in group II). Oral mucositis was observed in 25 patients (11 in group I and 14 in group II; in 21 cases it was of grade III and in 4 cases of grade IV) and fever of unknown origin in 6 patients (2 in group I and 4 in group II). Acute GvHD occurred in 28 patients (13 in group I and 15 in group II) and chronic GvHD in 3 (2 in group I and 1 in group II). There was a relapse of malignancy in 9 patients (4 in group I and 5 in group II).

Statistical analysis showed significant correlation ($P=0.035$) between febrile temperatures and semi-impacted teeth. There was no significant correlation found between age or gender and post-Tx complications post-SCT ($P=0.223$; $P=0.590$), post-LTx ($P=0.512$; $P=0.590$) and post-HTx ($P=0.844$; $P=0.580$) respectively.

The impact of dental foci on the occurrence of post-Tx infections was not statistically significant post-SCT ($P=0.890$), post-LTx ($P=0.124$) and post-HTx ($P=0.147$).

Table 1 Pathological findings pre-Tx (n=102 patients)

	SCT	LTx	HTx	Total (n)
Decayed teeth	34	12	10	56
Semi-impacted teeth	9	5	6	20
Impacted teeth	27	9	14	50
Retained teeth	17	16	5	38
Periapically infected teeth	23	13	6	42
Periodontally infected teeth	20	10	9	39

Table 2 Dental rehabilitation pre-Tx (n=70 patients)

	Clinic	alio loco	total (n)
Extractions	5	26	31
Osteotomies	6	3	9
Apicoectomies	2	1	3
Fillings	0	3	3
Root canal therapies	2	3	5

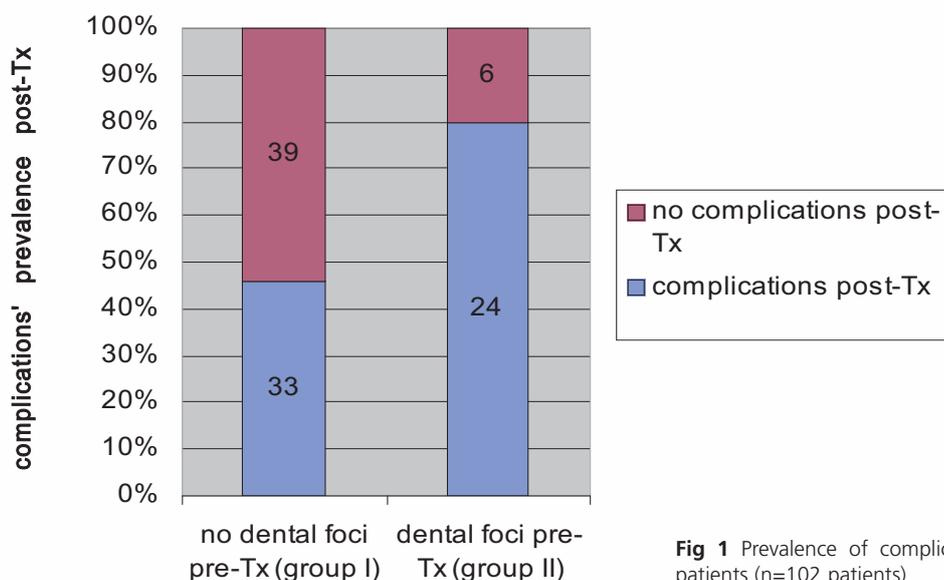


Fig 1 Prevalence of complications post-Tx for the two groups of patients (n=102 patients)

Also, the survival rate was not affected by preexisting foci post-SCT ($P=0.118$), post-LTx ($P=0.752$) and post-HTx ($P=0.844$).

Acute GvHD post-SCT was found to be significantly associated with dental foci ($P=0.002$), especially with impacted teeth ($P=0.005$) and periapically infected teeth ($P=0.0034$). No relationship between periapical radiolucencies and infections was established in the untreated SCT-patients ($P=0.819$).

DISCUSSION

Organ transplantation has been established as a standard therapeutic method.

Dental management of transplantation candidates has become the standard care procedure accordingly; the principal goal is to eliminate all potential oro-dental sources of infection and to reduce mortality and morbidity that may arise from oral complications associated with transplantation (Boraz, 1986; Eigner et al, 1986; Harms and Bronny, 1986; Bergmann, 1988; Sonis and Kunz, 1988; Schmelzeisen et al, 1991; Little and Rhodus, 1992; Plachetzky et al, 1992; Glassman et al, 1993; Golder and Drinnan, 1993; Peters et al, 1993; Sakurai et al, 1995; Barbero et al, 1996; Krennmair et al, 1996; Sonner et al, 1996; Weingart et al, 1996; Bader et al, 1997; Douglas et al, 1998; Morimoto et al, 1998; Meyer et al, 1999; Heimdahl, 1999; Sheehy et al, 1999; Folwaczny and Hickel, 2001; Otten, 2001).

To date little has been published regarding dental preparation of patients considered for organ transplantation. There are no widely accepted guidelines as to

which specific dental screening outcomes should be pursued with pre-Tx management, a fact which has resulted in various concepts regarding the extent of dental treatment in such patients. While most authors agree that periodontal treatment and extraction of unrestorable teeth should be performed before transplantation, opinions vary concerning the extraction of teeth with root-canal fillings which have no clinical or radiological symptoms and the surgical removal of fully or partially impacted teeth (Wilson et al, 1982; Boraz and Myers, 1990; Peters et al, 1993; Sonner et al, 1996; Weingart et al, 1996; Klempnauer, 1997; Meyer et al, 1999; Majorana et al, 2000; Folwaczny and Hickel, 2001; Akintoye et al, 2002). Oral hygiene techniques, including tooth brushing, flossing, diet modification, use of antimicrobial mouth rinses and topical fluorides are initiated, reviewed, and used by all patients. However, patients with poor dental status who have demonstrated little interest or ability to improve their oral hygiene must be advised to have their teeth extracted and dentures made (Rhodus and Little, 1992; Sonner et al, 1996). Retained roots and fully impacted teeth without clinical or radiological symptoms are left in place, while implants with a probing depth more than 7 mm must be explanted (Folwaczny and Hickel, 2001).

The increase however in the number of organ transplant patients has also an impact on oral and dental services provided pre-Tx, which are likely to increase proportionally to the expanding replacement of failing organs (Guggenheimer et al, 2003).

In our retrospective study we observed a higher rate of complications in patients of group II, who had no den-



tal treatment pre-Tx, a fact that indicates the importance of dental screening and appropriate intervention pre-Tx.

The finding that preexisting dental foci did not affect the incidence of life-threatening infections and survival rate post-Tx may be due to the small number of patients, and is in agreement with the findings by Sonner et al (1996) who examined LTx-patients and with the findings of Weingart et al (1996) and of Meyer et al (1999), who studied different groups of HTx-patients.

The correlation between febrile temperatures and semi-impacted teeth is also noted by Wilson et al (1982), while other authors suggested the prophylactic extraction of impacted teeth, because they can be potential sources of infections in immunosuppressed patients (Plachetzky et al, 1992; Weingart et al, 1996; Meyer et al, 1999; Strietzel et al, 2001).

The finding that untreated periapical radiolucencies did not affect the incidence of infection post-SCT is in agreement with the results found by Peters et al (1993) in their patients who were left untreated before SCT. A significant correlation between dental foci and the incidence of acute GvHD was found, although this was also recorded in patients who underwent dental treatment. In a retrospective analysis of 446 patients who received SCT, Nash et al (1992) found that increasing patient age, increasing donor age, and patient donor sex mismatch were significantly associated with the risk of developing acute GvHD. A history of pregnancy in female donors was also a predictive factor, while disease status before SCT and intensity of total body irradiation in the conditioning regimen significantly affected the risk of acute GvHD. A possible relationship between oral health and presentation of GvHD was not established.

On the basis of the 102 patients in this study we can conclude that dental treatment prior to organ transplantation does not have to be radical. It may be combined with preventive dentistry and teeth restoration techniques. Maintenance of good oral hygiene is the most essential part in the oral health of transplanted patients. Dental intervention must always be adjusted individually to the medical and dental status of each patient.

It is obvious that further studies are required to evaluate the efficacy of dental management prior to organ transplantation and to distinguish those findings that mandate treatment from those that don't adversely affect the medical outcome if left untreated. Evidence-based research studies, which can lead to the development of clear guidelines as to which specific screening outcomes should be pursued with dental intervention are warranted.

REFERENCES

Akintoye SO, Brennan MT, Graber CJ, McKinney BE, Rams TE, Barrett AJ et al. A retrospective investigation of advanced periodontal disease as a risk factor for septicemia in hematopoietic stem cell and

- bone marrow transplant recipients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2002;94:581-588.
- Bader G, Mesner M, Lejeune S. Oral surgery for liver transplant patients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1997;84:593.
- Barbero P, Carzino Demo MG, Milanese M, Ottobrelli A. The dental assessment of the patient waiting for a liver transplant. *Minerva Stomatol* 1996;45:431-439.
- Bergmann O. Oral infections and septicemia in immunocompromised patients with hematologic malignancies. *J Clin Microbiol* 1988;26:2105-2109.
- Boraz RA. A dental protocol for the pediatric cardiac transplant patient. *J Dent Child* 1986;53:382-385.
- Boraz RA, Myers R. A national survey of dental protocols for the patient with a cardiac transplant. *Spec Care Dentist* 1990;10:26-32.
- Busuttill RW, Goldstein LI, Danovitch GM, Ament ME, Memsic LDF. Liver transplantation today. *Ann Intern Med* 1986;104:377-389.
- Busuttill RW, Shaked A, Millis JM. One thousand liver transplants: the lessons learned. *Ann Surg* 1994;219:490-497.
- Dajani AS, Taubert KA, Wilson W, Bolger AF, Bayer A, Ferrieri P et al. Prevention of bacterial endocarditis – Recommendation by the American Heart Association. *J Am Med Assoc* 1997;277:1794-1801.
- Douglas LR, Douglass JB, Sieck JO, Smith PJ. Oral management of the patient with end-stage liver disease and the liver transplant patient. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1998;86:55-64.
- Eigner TL, Jastak JT, Bennet WM. Achieving oral health in patients with renal failure and renal transplants. *J Am Dent Assoc* 1986;113:612-616.
- Einsele H, Kanz L. Allogene Stammzelltransplantation. *Internist (Berl)* 1999;40:1249-1256.
- Eurotransplant homepage: <http://www.eurotransplant.org>
- Folwaczny M, Hickel R. Aspekte der zahnärztlichen Betreuung immunsupprimierter Patienten. II. Hämatologische Erkrankungen, Chemotherapie und Knochenmarktransplantation sowie Organtransplantation. *Dtsch Zahnärztl Z* 2001;56:354-369.
- German Society of Dental Oral and Craniomandibular Sciences (DGZMK). Zahnsanierung vor und nach Organtransplantation. *Dtsch Zahnärztl Z* 1999;54:532-533.
- Glassman P, Wong C, Gish R. A review of liver transplantation for the dentist and guidelines for dental management. *Spec Care Dent* 1993;13:74-80.
- Golder DT, Drinnan AJ. Dental aspects of cardiac transplantation. *Transplant Proc* 1993;25:2377-2380.
- Groth CG, Brent LB, Calne RY, Dausset JB, Good RA, Murray JE et al. Historic landmarks in clinical transplantation: conclusions from the consensus conference at the University of California, Los Angeles. *World J Surg* 2000;24:834-843.
- Guggenheimer J, Eghtesad B, Stock DJ. Dental management of the (solid) organ transplant patient. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2003;95:383-389.
- Harms KA, Bronny AT. Cardiac transplantation: dental considerations. *J Am Dent Assoc* 1986;112:677-681.
- Heimdahl A. Prevention and management of oral infections in cancer patients. *Support Care Cancer* 1999;7:224-228.
- Hetzer R, Warnecke H, Schüler S, Süthof U, Wonigeit K, Lang W et al. Herztransplantation. *Internist* 1985;26:563-568.



- Klempnauer J. Risiken für die zahnärztliche Chirurgie als Folge der Immunsuppression bei Organtransplantation. Dtsch Zahnärztl Z 1997;52:10-14.
- Krennmair G, Roithinger FX, Puschmann R, Pachinger O. Dentogene Infektionsquellen von Patienten mit bevorstehendem Herzklappenersatz. Wien Klin Wochenschr 1996;108:289-292.
- Lazarchik DA, Filler SJ, Winkler MP. Dental evaluation in bone marrow transplantation. Gen Dent 1995;43:369-371.
- Little JW, Rhodus NL. Dental treatment of the liver transplant patient. Oral Surg Oral Med Oral Pathol 1992;73:419-426.
- Majorana A, Schubert MM, Porta F, Ugazio AG, Sapelli PL. Oral complications of pediatric hematopoietic cell transplantation: diagnosis and management. Support Care Cancer 2000;8:353-65.
- Margolis J, Borrello I, Flinn IW. New approaches to treating malignancies with stem cell transplantation. Semin Oncol 2000;27:524-530.
- Meyer U, Weingart D, Deng MC, Scheld HH, Joos U. Heart transplants-assessment of dental procedures. Clin Oral Invest 1999;3:79-83.
- Morimoto A, Morimoto Y, Maki K, Nishida I, Kawahara H, Kimura M. Dental treatment of a prospective recipient of a liver transplant: a case report. J Clin Pediatr Dent 1998;23:75-78.
- Nash RA, Pepe MS, Storb R, Longton G, Pettinger M, Anasetti C et al. Acute graft versus-host disease: analysis of risk factors after allogeneic marrow transplantation and prophylaxis with cyclosporin and methotrexate. Blood 1992;80:1838-1845.
- Neuhaus, R. Personal communication (2004).
- Otten JE. Zahnsanierung vor und nach Organtransplantation. Zahnärztl Mittel 2001;91:38-39.
- Peters E, Monopoli M, Woo SB, Sonis S. Assessment of the need for treatment of postendodontic asymptomatic periapical radiolucencies in bone marrow transplantation. Oral Surg Oral Med Oral Pathol 1993;76:45-48.
- Pichlmayr R. Stand und Entwicklung der Transplantationsmedizin. Dtsch Ärztebl 1989;86:1198-1200.
- Plachetzky U, Novacek G, Tuppy F, Walgram M, Vogelsang H, Ferenci P et al. Ergebnisse der Herdsuche und Herdsanierung im Bereich der Zahn-, Mund- und Kieferheilkunde bei 50 Lebertransplantationskandidaten. Z Stomatol 1992;89:309-317.
- Rhodus NL, Little JW. Dental management of the bone marrow transplant patient. Compend Contin Educ Dent 1992;13:1040-1046.
- Sakurai K, Drinkwater D, Sutherland DE, Fleischmann J, Hage A, Yonemura C. Dental treatment considerations for the pre- and post-organ transplant patient. Calif Dent Assoc 1995;23:61-68.
- Schmelzeisen R, Eckardt A, Knoll M, Girod S. Special considerations in dental surgery procedures on organ transplantation patients. Dtsch Z Mund Kiefer Gesichtschir 1991;15:431-434.
- Secola R. Hematopoietic stem cell transplantation: a glimpse of the past and a view of the future. J Pediatr Oncol Nurs 2001;18:171-177.
- Seymour RA, Thomason JM, Nolan A. Oral lesions in organ transplant patients. J Oral Pathol Med 1997;26:297-304.
- Sheehy EC, Heaton N, Smith P, Roberts GJ. Dental management of children undergoing liver transplantation. Pediatr Dent 1999;21:272-280.
- Sonis ST, Kunz A. Impact of improved dental services on the frequency of oral complications of cancer therapy. Oral Surg Oral Med Oral Pathol 1988;65:19-22.
- Sonner S, Neuhaus R, Schröder S, Becker J, Reichart PA. Zahnärztlich-chirurgische Sanierung von 320 Lebertransplantationspatienten. Dtsch Zahnärztl Z 1996;51:794-796.
- Storb R, Buckner CD. Human bone marrow transplantation. Eur J Clin Invest 1990;20:119-132.
- Strietzel FP, Neukam FW, Hirschfelder U, Reichart PA. Indikationen zur operativen Weisheitszahnentfernung. Wissenschaftliche Stellungnahme der Deutsche Gesellschaft für Zahn-, Mund- und Kieferheilkunde. Dtsch Zahnärztl Z 2001;56:450-451.
- Svirsky JA, Savaria ME. Dental management of patients after liver transplantation. Oral Surg Oral Med Oral Pathol 1989;67:541-546.
- United Network for Organ Sharing Homepage: <http://www.unos.org>
- Waltimo T, Christen S, Meurman JH, Filippi A. Zahnärztliche Betreuung von Leukämiepatienten. Schweiz Monatschr Zahnmed 2005;115:308-315.
- Weingart D, Meyer U, Roeder N, Scheld HH, Joos U. Operation am offenen Herzen-Stellenwert der dentoalveolären Sanierung. Dtsch Zahnärztl Z 1996;51:773-775.
- Wilson R, Martinez-Tirado J, Whelchel J, Lordon R. Occult dental infection causing fever in renal transplant patients. Am J Kidney Dis 1982;2:354-357.

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* *The study presented here was the subject of the doctorate thesis of the first author (Dr. med. dent.- thesis, Medical Faculty, Humboldt University (Charité), 2002, Berlin, Germany) and the results were partly presented as a poster during the 7th Biennial Congress of the European Association of Oral Medicine (September 23-25, 2004, Berlin, Germany).*