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# Prosthetic hygiene and functional efficacy in completely edentulous patients: satisfaction and quality of life during a 5-year follow-up

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## Abstract

**Objectives:** The aim of this study was to compare satisfaction with function and hygiene maintenance in completely edentulous elderly patients rehabilitated with implant-supported fixed prostheses, overdentures, and conventional prostheses.

**Materials and methods:** A total of 150 geriatric patients were divided into three groups: Group 1 (CD) patients rehabilitated with complete dentures; Group 2 (FP) patients with implant-supported fixed prostheses; Group 3 (OD) patients with overdentures. The patients responded to a questionnaire based on the Oral Health Impact Profile and the Dental Impact Profile to evaluate satisfaction with their prostheses. Data were analyzed using ANOVA F and the Kruskal–Wallis nonparametric test, with significance established as  $P < 0.05$ .

**Results:** Significant differences were found between the three groups. For oral hygiene, the group with overdentures showed better results, and the group with fixed prostheses was more satisfied with function.

**Conclusions:** Satisfaction among these completely edentulous patients varied in relation to prosthetic type. The level of general satisfaction among patients with implant-supported prostheses was greater than the group using conventional dentures. Patients rehabilitated with fixed prostheses enjoyed a higher level of satisfaction than patients with overdentures.

Dentition, or the lack of it, has a considerable impact on the lives of elderly patients. This has led to a great deal of research into oral health-related quality of life, and various systems and scales are in use that evaluate patient satisfaction (Attard et al. 2006; Mac Entee 2007; Dahl et al. 2011).

For decades, the only treatment available for tackling edentulism was the conventional denture. With the introduction of dental implants, the mandibular overdenture became the first viable alternative to the denture (Hug & Mericske-Stern 2006). This treatment option brought about a significant improvement in terms of stability, retention, masticatory force, and patient quality of life, and eliminated the adaptation problems associated with conventional dentures (Awad et al. 2003).

In the last 20 years, research into the quality of life of edentulous patients has found average satisfaction with overdentures to be

around 90% (Boerringter et al. 1995). Other authors have observed that patients' satisfaction and their subjective perception of oral hygiene, function, and esthetics in patients rehabilitated with implant-supported prostheses are higher than those in patients with conventional complete dentures (Grogono et al. 1989; Cibirka et al. 1997; ).

The aim of this study was to compare satisfaction with oral hygiene and function among an elderly population rehabilitated with conventional complete dentures, implant-supported fixed prostheses, or overdentures.

## Materials and methods

The study design followed guidelines established by the Declaration of Helsinki (version 2008) for research involving humans and was approved by the Ethics Board of the

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**Table 1. Patient characteristics (N = 150)**

Variables	Descriptive statistics	
	% (n)	P-value (Chi-squared test)
<b>Sociodemographic variables</b>		
Sex		
Males	43.3 (65)	P = 0.127 NS
females	56.7 (85)	
Age ranges		
<65	24.7 (37)	P < 0.001
66–80	50 (75)	
>81	25.3 (38)	
<b>Health variables</b>		
Smokers		
Yes	15.3 (23)	P = 0.005
No	84.7 (127)	
Alcohol consumption		
Yes	23.3 (35)	P < 0.001
No	76.7 (115)	
Daily tooth brushing		
None	0.7 (1)	P < 0.001
Once a day	11.3 (17)	
Twice a day	21.3 (32)	
Three times	65.3 (98)	
More than three times	1.3 (2)	
No. of visits to the dentist per year		
None	95.3 (143)	P < 0.001
One	1.3 (2)	
Two	2.7 (4)	
More than two	0.7 (1)	
<b>Clinical variables</b>		
Reason for loss of teeth		
Caries	32 (48)	P = 0.536 NS
Periodontitis	52 (78)	
Trauma	4 (6)	
Caries + periodontitis	12 (18)	
Presence of mucosal lesions		
Yes	22.7 (34)	P < 0.001
No	77.3 (116)	
<b>Variables related to prosthetic rehabilitation</b>		
Location		
Maxillary	40 (60)	P < 0.001
Mandibular	44 (66)	
Both	16 (24)	
Antagonist type		
Complete prosthesis	52.66 (79)	P < 0.001
Implant-supported prosthesis	17.34 (26)	
Tooth-supported	6.67 (10)	
Removable prosthesis	23.33 (35)	
<b>Periodontal examination</b>		
Plaque index		
Overdentures		
0	22 (11)	P = 0.781 NS
1	42 (21)	
2	32 (16)	
3	4 (2)	
Fixed prosthesis		
0	18 (9)	
1	38 (19)	
2	36 (18)	
3	8 (4)	
Gingival index		
Overdentures		
0	20 (10)	P = 0.875 NS
1	38 (19)	
2	28 (14)	
3	14 (7)	
Fixed Prosthesis		
0	18 (9)	P < 0.001
1	34 (17)	
2	28 (14)	
3	20 (10)	

Complutense University of Madrid (Spain). All participants gave their informed consent to take part.

This transversal retrospective study was conducted among a sample of nonprobabilistic consecutive cases. All patients fulfilling the inclusion criteria were recruited over time until the desired sample size of 150 patients had been completed. Inclusion criteria were as follows: completely edentulous patients, rehabilitated at least 5 years previously, who were willing to give their informed consent to provide personal information, to complete patient satisfaction surveys, and allow their clinical data to be used for research purposes.

A total of 150 edentulous patients (aged between 66 and 80 years, mean age 72 years) were divided into three groups of 50: Group 1 (CD) (23 women and 27 men) were rehabilitated with conventional complete dentures; Group 2 (FP) (29 women and 21 men) were rehabilitated with implant-supported fixed prostheses; Group 3 (OD) (23 women and 27 men) were rehabilitated with implant-retained overdentures.

Implant surgery was performed by a single surgeon using standard procedures. Rehabilitation of the 100 patients required a total of 790 Astra Tech (TM) implants. By agreement between the surgeon and the prosthetist, four implants were required in the upper maxillary to support an overdenture and eight to support a fixed prosthesis. In the mandible, four implants were needed to support an overdenture and six to support a fixed prosthesis. Patients were asked not to wear their former dentures for 1 week following surgery.

One year after conventional or implant-based rehabilitation, all patients underwent a clinical examination, whose findings are displayed in Table 1. Study variables were classified into five groups: sociodemographic; age, sex, and health variables; habits (smoking, alcohol consumption, oral hygiene regime) and number of visits to the dentist annually; clinical variables, such as the reason natural teeth were lost or presence/absence of oral mucosal lesions; type of rehabilitation and antagonist; periodontal analysis, evaluating probe depth and bone loss around each implant.

All patients were recalled to complete a questionnaire designed to evaluate functional and oral hygiene aspects of their new dental prosthesis. To avoid bias, the same surgeon carried out all the interviews with patients. The questionnaire consisted of nine questions (Table 2), taken from the Oral Health

**Table 1.** (continued)

Variables	Descriptive statistics	
	% (n)	P-value (Chi-squared test)
Bone loss		
Overdentures		
<1 mm	45 (23)	
1–3 mm	35 (17)	
>3 mm	20 (10)	
Fixed prosthesis		
<1 mm	18 (9)	
1–3 mm	42 (21)	
>3 mm	40 (20)	

NS; no significance ( $P > 0.05$ ).  
Significance  $\alpha = 0.05$ .  
Significance  $\alpha = 0.001$ .

Impact Profile (OHIP-14), which is an efficient method for gathering information related to the social repercussions of rehabilitative treatment (problems in the workplace, satisfaction with life in general, etc.) and to evaluate function (speech affectation, taste, etc.). However, the OHIP-14 does not evaluate some basic parameters related to prosthetic rehabilitation, and for this reason, a further two questions were taken from the Dental Impact Profile to complete the questionnaire.

The patients' responses took the form of a Likert scale, whereby patients have five options of 0–4 points (never = 0; hardly ever = 1; occasionally = 2; fairly often = 3; very often = 4). The final score is the total of the points awarded, with high scores indicating low levels of satisfaction.

Data were analyzed applying the Kruskal–Wallis nonparametric test; the significance level was established as  $P < 0.05$ . The three groups were compared with each other to highlight which was the different group (Mann–Whitney test).

## Results

Three patients were excluded from the original study population ( $n = 153$ ) as they had changed telephone number or address, and it was no longer possible to contact them. The age of the participants was between 66 and 80 years ( $P < 0.001$ ). The chi-squared test showed that frequency distribution for gender between the groups was not significant ( $P = 0.127$ ).

Regarding oral health regimes, 65.3% of patients brushed their teeth three times a day; 95% did not visit the dentist every year. Most patients did not smoke or drink alcohol, with statistically significant differences. 77.3% of patients did not present lesions of the oral mucosa; 52% had lost their teeth from periodontal disease.

As for variables relating to prostheses, complete dentures were the most common antagonist type and the distribution of location was homogenous between groups. No statistically significant differences were seen in plaque and gingival indices between the two types of implant-supported prosthesis. However, more bone loss occurred around implants supporting fixed prostheses ( $P < 0.001$ ).

Analysis of overall satisfaction in each group was performed by dividing the total scores into three groups, those patients who had given scores of 0–2 points were considered as experiencing almost complete satisfaction, 3–9 points indicated average satisfaction, and scores over ten points were considered to indicate dissatisfaction. Only 14% of patients with conventional dentures experienced almost complete satisfaction (with significant difference, chi-squared test  $P = 0.001$ ), compared to 36% of patients with overdentures and 46% of patients with fixed prostheses. In this way, almost half the patients with fixed prostheses were highly satisfied Table 3.

**Table 2.** Survey of satisfaction with function and hygiene maintenance

	Group 1 CD Mean $\pm$ SD Medium	Group 2 FP Mean $\pm$ SD Medium	Group 3 OP Mean $\pm$ SD Medium	Kruskal–Wallis	Mann–Whitney
1. Difficulty pronouncing some words	2.24 $\pm$ 1.67 <sup>†</sup> 3.00	0.52 $\pm$ 0.97 0.00	1.14 $\pm$ 1.15 0.00	<0.001*	FP = OP
2. Worse sense of taste	1.06 $\pm$ 1.096 1.00	0.28 $\pm$ 0.67 <sup>†</sup> 0.00	0.90 $\pm$ 0.995 1.00	<0.001*	CD = OP
3. Pain in the mouth	2.50 $\pm$ 1.64 <sup>†</sup> 3.00	0.66 $\pm$ 1.18 0.00	0.90 $\pm$ 1.129 0.00	<0.001*	FP = OP
4. Discomfort eating some foods	2.04 $\pm$ 1.641 <sup>†</sup> 2.50	0.64 $\pm$ 1.025 0.00	0.84 $\pm$ 1.235 0.00	<0.001*	FP = OP
5. Unsatisfactory diet	1.58 $\pm$ 1.540 <sup>†</sup> 1.00	0.14 $\pm$ 0.452 0.00	0.24 $\pm$ 0.797 0.00	<0.001*	FP = OP
6. Interruption of meals	2.24 $\pm$ 1.349 <sup>†</sup> 3.00	1.12 $\pm$ 0.982 2.00	1.40 $\pm$ 1.471 1.00	<0.001*	FP = OP
7. Functional disability	0.00 $\pm$ 0.00 0.00	0.02 $\pm$ 0.141 0.00	0.06 $\pm$ 0.314 0.00	0.360 NS	NS
8. Halitosis	0.34 $\pm$ 0.714 0.00	1.28 $\pm$ 1.246 <sup>†</sup> 1.50	0.40 $\pm$ 0.857 0.00	<0.001*	CD = OP
9. Difficulty cleaning prosthesis	0.04 $\pm$ 0.198 0.00	1.54 $\pm$ 1.417 <sup>†</sup> 1.50	0.78 $\pm$ 1.055 0.00	<0.001*	CD = OP

NS, not significant.

= Both groups with no statistically significant differences

How often have you had the following problems in the last year?

0 = Never; 1 = Hardly ever; 2 = Occasionally; 3 = Fairly often; 4 = Very often.

\*Statistically significant differences for values where  $\alpha < 0.05$

<sup>†</sup>This group differs from the other two.

When individual questionnaire items were analyzed, significant differences were found between the study groups for all questions except the seventh, which asked if patients felt themselves to be functionally incapacitated by the prosthesis; this provoked an average response of close to zero, in other words "never." However, patients wearing

complete dentures did suffer functional limitations (42% of cases) compared with patients with overdentures (25%) and fixed prostheses (19%). For example, the prostheses were the cause of difficulties in pronouncing certain phonemes, altered the flavor of foods, caused the interruption of meals due to impacted food, etc.

Regarding oral hygiene, patients rehabilitated with fixed prostheses showed significantly lower levels of satisfaction with this aspect of the treatment. Figures 1 and 2.

### Discussion

The predictability of implant osseointegration has been confirmed (Lekholm et al. 1999), and numerous studies have reported successful outcomes for implant-supported prostheses (Leung & Cheung 2003), so that this treatment option is on the increase among patients with partial or complete edentulism.

In addition to the present study, the literature includes a large number of studies that have assessed the reactions of completely edentulous patients to treatments involving implants. Most have mentioned improvements in quality of life in patients formerly wearing dentures, who have then been rehabilitated with implants supporting overdentures (Esfandiari et al. 2009; Visser et al. 2009).

Randomized clinical studies are needed to provide concrete evidence of the efficacy of treatment, and the evaluation method chosen must be able to detect real differences effectively. This study set out to analyze the opinions of a population of completely edentulous geriatric patients, and identified greater satisfaction among patients treated with implant-supported prostheses than those wearing conventional complete dentures, regardless of the type of implant-supported prosthesis (Heydecke et al. 2005; Kimoto & Garrett 2005).

The mean age of the patient sample in the present study was higher than in other similar studies analyzing satisfaction among edentulous patients (Albaker 2013). Age does not contraindicate rehabilitation by implants, but does appear to influence the type of rehabilitation chosen by the patient (Awad et al. 2003). In the present study, older patients opted for less complicated and costly treatments that did not require surgery, such as conventional dentures, or treatments requiring fewer implants such as overdentures. Meanwhile, younger patients preferred fixed

**Table 3. Inferential analysis of overall satisfaction by groups**

Chi-squared. <i>P</i> = 0.001	Overall satisf.			Total
	GL = 0–2	GL = 3–9	GL >=10	
<b>Overdenture</b>				
Count	18	19	13	50
% within type	36.0	38.0	26.0	100.0
Corrected residues	0.7	−1.2	0.5	
<b>Fixed</b>				
Count	23	14	13	50
% within type	<b>46.0</b>	28.0	26.0	100.0
Corrected residues	2.6	−2.9	0.5	
<b>Complete dentures</b>				
Count	7	34	9	50
% within type	14.0	68.0	18.0	100.0
Corrected residues	−3.3	4.1	−1.1	
<b>Total</b>				
Count	48	67	35	150
% within type	32.0	44.7	23.3	100.0

Bold value denotes nearly half of patients with fixed prosthesis had a very high satisfaction.

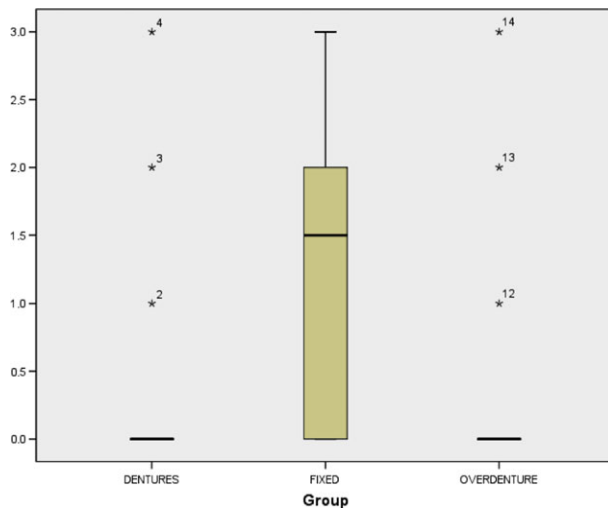


Fig. 1. Boxplot for question 8 (Do you have halitosis?).

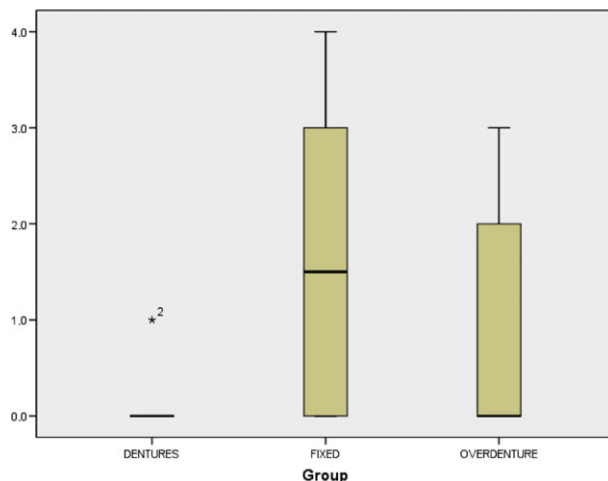


Fig. 2. Boxplot for question 9 (Do you have difficulty cleaning the prosthesis?).

prostheses in spite of the additional cost and surgical procedures that this type of treatment involves.

Patient gender did not condition preferences for one type of prosthesis or another; however, there did seem to be gender differences in pre-operative anxiety, women being more nervous than men, and also in satisfaction with the capacity to eat and with prosthetic esthetics, these being significantly lower among women with conventional rehabilitations (dentures) (González-Lemonnier et al. 2010). In a study by Esquivel and Jiménez, of 53 patients with a mean age of 57 years that assessed quality of life in relation to oral health, the authors concluded that there were no statistically significant differences between men and women. The study used the General Oral Health Assessment Index (GOHAI) to measure patient satisfaction with conventional prosthetic rehabilitations (Esquivel & Jiménez 2012). In the present study, gender did not condition the choice of treatment or satisfaction with the outcomes.

As for patient habits, these clearly do condition treatment success. The frequency of smoking and daily cigarette consumption and duration of smoking are directly related to implant loss, with significant differences between smokers and nonsmokers (11.28% in smokers compared with 4.76% in nonsmokers) (Winkel et al. 2001).

When the etiology of edentulism is related to implant failure, there is a clear qualitative risk. Depending on the cause of dental loss, the risk of implant loss can be classified as low, medium, or high. It is considered to be low when teeth are lost due to caries or trauma, medium when the cause is periodontal disease, and high when the patient presents bruxism or severe occlusal disorders. In the present study, half the patients had lost their teeth as a result of periodontitis and the other half from caries or trauma, so half the sample presented a low risk of implant failure and half medium risk (Becerra 2005).

The literature includes various examples of vertical bone loss observed around implants supporting overdentures, reaching 1.66 mm after 12 years, a finding that coincides with the present study (van Steenberghe et al. 2001; Attard & Zarb 2004). For fixed prostheses, the present study found bone losses that were greater than in another published work (Francetti et al. 2012) that obtained a mean bone loss of 2.8 mm around implants supporting fixed prostheses. The present study found that the bone loss around implants was greater in patients with fixed prostheses than those rehabilitated with overdentures, with statistically significant difference. The likely cause of the reduced bone loss is the ease of oral hygiene maintenance with overdentures, which are removable.

If the basic objective of any dental prosthesis is to restore function and esthetics and to replace missing teeth, this study has confirmed that these objectives were clearly satisfied for the majority of patients rehabilitated with implant-based treatments. They found that they could eat satisfactorily with their new prostheses, had no difficulties speaking, did not suffer any pain, did not experience alterations in the flavor of foods, and were not forced to interrupt meals due to buildups of impacted food (Baat et al. 1997).

In a study by Grogono et al. (1989), 82% of patients enjoyed an improvement in masticatory force after treatment with implants. Most of the patients treated with implant-supported prostheses claimed that they felt like "a part of themselves." Geertman et al. (1996) made two studies that also evaluated masticatory ability, comparing complete denture wearers, with patients rehabilitated with overdentures. The studies found significantly better outcomes in the group of patients with implant-supported prostheses, who reported an improvement in their chewing ability.

Questions related to oral hygiene are important for biological reasons and for the sake of long-term success as the formation of plaque in the peri-implant groove must be

kept to a minimum (Göthberg et al. 2003). The present study obtained lower levels of satisfaction with oral hygiene among patients rehabilitated with fixed prostheses, with statistically significant differences. These patients reported suffering a higher percentage of cases of halitosis than the other two groups with removable prostheses. This finding coincided with the difficulties of cleaning these prostheses, a parameter that also showed significant differences between groups. At the same time, a high percentage of patients treated with overdentures (66.67%) claimed to suffer no cleaning complications, which is to be expected with a removable prosthesis.

The objectives that patients hope and expect to fulfill by undergoing rehabilitation will determine subjective treatment outcomes unconditionally. The present work set out to evaluate edentulous patients' opinions of the complete rehabilitations they had received, either by conventional or implant-supported means. In terms of clinical practice, this is a matter of deciphering the hopes and wishes of the individual patient to ensure that the treatment provided does not hold any surprises but meets his/her demands and expectations. This, of course, must run parallel to the dentist's objective analysis of clinical and radiographic parameters.

## Conclusions

Most patients undergoing implant-supported rehabilitations experienced a good level of general satisfaction. Awareness of patients' subjective perceptions helps the dentist to form an objective view of the advantages and disadvantages of each type of prosthetic rehabilitation, which will help to avoid false expectations among patients that might decrease their level of satisfaction with treatment outcomes.

## References

- Albaker, A.M. (2013) The oral health-related quality of life in edentulous patients treated with conventional dentures. *Gerodontology* **30**: 61–66.
- Attard, N.J., Laporte, A., Locker, D. & Zarb, G.A. (2006) A prospective study on immediate loading of implants with mandibular overdentures: patient-mediated and economic outcomes. *International Journal of Prosthodontics* **19**: 67–73.
- Attard, N.J. & Zarb, G.A. (2004) Long-term treatment outcomes in edentulous patients with implant overdentures: the Toronto study. *International Journal of Prosthodontics* **17**: 425–433.
- Awad, M.A., Lund, J.P., Shapiro, S.H., Locker, D., Klemetti, E., Chehade, A., Savard, A. & Feine, J.S. (2003) Oral health status and treatment satisfaction with mandibular implant overdentures and conventional dentures: a randomized clinical trial in senior population. *International Journal of Prosthodontics* **16**: 390–396.
- Baat, C., Van Aken, A., Mulder, J. & Kalk, W. (1997) Prosthetic condition and patients' judgment of complete denture. *Journal Prosthetic Dentistry* **78**: 472–478.
- Becerra, S.G. (2005) Fundamentos biomecánicos en rehabilitación oral. *Revista Facultad de Odontología Universidad de Antioquia* **17**: 67–83.
- Boerringer, E.M., Geertman, M.E., Van Oort, R.P., Bouma, J., Raghoebar, G.M., van Vaas, M.A., van't Hof, M.A., Boering, G. & Kalk, W. (1995) Patient satisfaction with implant-retained mandibular overdentures. A comparison with new complete dentures not retained by implants a

- multicentre randomised clinical trial. *British Journal Oral and Maxillofacial Surgery* **33**: 282–288.
- Cibirka, R.M., Razzoog, M. & Lang, B.R. (1997) Critical evaluation of patient responses to dental implant therapy. *Journal of Prosthetic Dentistry* **78**: 574–581.
- Dahl, K.E., Wang, N.J., Skau, I. & Ohm, K. (2011) Oral health-related quality of life and associated factors in Norwegian adults. *Acta Odontologica Scandinavica* **69**: 208–214.
- Esfandiari, S., Lund, J., Penrod, J., Savard, A., Thomason, J.M. & Feine, J. (2009) Implant overdentures for edentulous elders: study of patient preference. *Gerodontology* **26**: 3–10.
- Esquivel, R.I. & Jiménez, J. (2012) The effect of the use of dental prostheses on perceptions of oral health. *ADM* **69**: 69–75.
- Francetti, L., Romeo, D., Corbella, S., Taschieri, S. & Del Fabbro, M. (2012) Bone level changes around axial and tilted implants in full-arch fixed immediate restorations. Interim results of a prospective study. *Clinical Implant Dentistry and Related Research* **14**: 646–654.
- Geertman, M.E., Boerrigter, E.M., van't Hof, M.A., van Waas, M.A.J., van Oort, R.P., Boering, G. & Kalk, W. (1996) Two-center clinical trial of implant-retained mandibular overdentures versus complete dentures – chewing ability. *Community Dentistry and Oral Epidemiology* **24**: 79–84.
- González-Lemonnier, S., Bovaira-Forner, M., Peñarocha-Diago, M. & Peñarocha-Oltra, D. (2010) Relationship between preoperative anxiety and postoperative satisfaction in dental implant surgery with intravenous conscious sedation. *Medicina Oral, Patología Oral y Cirugía Bucal* **15**: 379–382.
- Göthberg, C., Bergendal, T. & Magnusson, T. (2003) Complications after treatment with implant-supported fixed prostheses: a retrospective study. *International Journal of Prosthodontics* **16**: 201–207.
- Grogono, A.L., Lancaster, D.M. & Finger, I.M. (1989) Dental implants: a survey of patients' attitudes. *Journal of Prosthetic Dentistry* **62**: 573–576.
- Heydecke, G., Thomason, M., Lund, J. & Feine, J. (2005) The impact of conventional and implant supported prostheses on social and sexual activities in edentulous adults. Result from a randomized trial 2 months after treatment. *Journal of Dentistry* **33**: 649–657.
- Hug, S. & Mericske-Stern, R. (2006) Clinical evaluation of 3 overdenture concepts with tooth roots and implants: 2-year results. *International Journal of Prosthodontics* **19**: 236–243.
- Kimoto, K. & Garrett, N.R. (2005) Effect of mandibular ridge height on patients' perception with mandibular conventional and implant-assisted overdentures. *The International Journal of Oral & Maxillofacial Implants* **20**: 762–768.
- Lekholm, U., Gunne, J., Henry, P., Higuchi, K., Lindén, U., Bergström, C. & Van Steenberghe, D. (1999) Survival of the Brånemark implant in partially edentulous jaws: a 10-year prospective multicenter study. *The International Journal of Oral & Maxillofacial Implants* **14**: 639–645.
- Leung, A.C. & Cheung, L.K. (2003) Dental implants in reconstructed jaws: patient's evaluation of functional and quality of life outcomes. *The International Journal of Oral & Maxillofacial Implants* **18**: 127–134.
- Mac Entee, M.I. (2007) Quality of life as an indicator of oral health in older people. *The Journal of the American Dental Association* **138**: 47s–52s.
- van Steenberghe, D., Quirynen, M., Naert, I., Maffeï, G. & Jacobs, R. (2001) Marginal bone loss around implants retaining hinging mandibular overdentures, at 4-, 8- and 12-years follow-up. *Journal of Clinical Periodontology* **28**: 628–633.
- Visser, A., Raghoobar, G.M., Meijer, H.J. & Vissink, A. (2009) Implant-retained maxillary overdentures on milled bar suprastructures: a 10-year follow-up of surgical and prosthetic care and aftercare. *International Journal of Prosthodontics* **22**: 181–192.
- Winkel, E.G., Van Winkelhoff, A.J., Timmerman, M.F., Van Der Velden, U. & Van Der Weijden, G.A. (2001) Amoxicillin plus metronidazole in the treatment of adult periodontitis patients. A double-blind placebo-controlled study. *Journal of Clinical Periodontology* **28**: 296–305.