ORIGINAL RESEARCH

Longitudinal study of dental implants in hiv positive patients-An original research

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ABSTRACT

Aim: Purpose of the present research was to assess the outcome of dental implant success in HIV positive patients.

Methodology: Twenty patients testing positive for the human immunodeficiency virus were recruited for this study. Twenty-one negative control patients were also selected, for a total of 41 patients. Diagnostic impressions were collected and cone beam computed tomography images were obtained. Implant size and positioning were planned using cone beam computed tomography software. Two stage or single surgery was performed as determined by the surgeon (periodontist). After a six month healing period, definitive impressions were fabricated using polyvinyl siloxane impression material. Implant stability quotient values were obtained at the time of surgery and placement of the restoration. Screw retained custom titanium abutments were designed, milled, and placed with 25 N·cm torque using a calibrated torque controller. Porcelain fused-to-metal complete coverage restorations were then cemented with elastomeric resin implant cement. Implants and restorations were assessed at 6 month intervals over a period of 3 years for stability, peri-implant health, and patient satisfaction.

Results: Over the three year period, 25 of 42 implants placed in the negative control group were assessed, and 17 of 27 implants placed in the positive control group were evaluated. The overall patient retention rate was 77 percent. At the three year follow

up, restorations examined were fully functional and causing no pain. Overall implant retention within the positive group was 96 percent. Implant retention within the negative control group was 100 percent. No differences were noted between groups for bone loss based on statistical tests.

Conclusion: Within the limitations of this clinical investigation, the presence of human immunodeficiency virus per se was not a contraindication to dental treatment with implant-supported restorations.

Keywords: HIV, implant, clinical trial, implant-supported restorations.

INTRODUCTION

HIV infection continues to be a life-threatening disease. In 2009, an estimated 2.6 million newly infected cases were reported.[1] Although the growth rate has plateaued in the last decade, numbers still run high.[2] Prevention efforts, scientific research, and the development of new medication have led to improve the quality and life expectancy of HIV-positive patients.[3-5] Antiretroviral therapy has been proven to be a lifesaving approach for many millions infected.[6] Advances in HIV treatment have improved since the first antiretroviral, zidovudine, in 1987. A monotherapy of nucleoside reverse transcriptase inhibitor (NRTI) provided dramatic survival benefit but did not sustain viral progression. In the 1990s, protease inhibitors (PI) changed the course of HIV epidemic. Combination therapy led to rapid reduction of HIV RNA and improved immune function. In 2014, there are 28 antiretroviral drugs belonging to six different mechanistic classes. Older agents were replaced by new drugs that are more potent, less toxic, and less dosing frequency.[1] Advances in the last and availability of antiretroviral therapy have led to dramatic reductions in the mortality and morbidity of HIV patients.[4] Antiretroviral therapy is also effective in lowering the risk of mother-to-child transmission as well as a post-exposure prophylaxis measure for individuals exposed to HIV.[7] Current knowledge suggests that both, HIV and antiretroviral therapy, are likely to contribute to bone disorders, such as osteopenia and osteoporosis.[8,9] The virus itself affects osteoblast and osteoclast function. Antiretroviral therapy, especially the initial dosages, seems to accelerate bone mineral loss.[10,11] Unlike orthopedic implants which are in a closed environment, dental implants have direct communication to the oral cavity. Exposure to microflora of the mouth in conjunction with immunosuppression may affect the long-term outcome of dental implants.[1] Despite the adverse effects, the use of antiretroviral therapy has led HIV-positive patients to maintain low viral loads and normal CD4 counts making them more likely to opt for an elective surgery such as dental implants. Systematic review by Ata-Al et al. [12] mentions the prognosis of dental implants in HIV-positive patients to be similar to that of HIV-negative patients. Strietzel et al. [13] concluded that no modification in the dental routine is required for HIV-positive patients. Oliveira et al. [14], in a pilot study, compared 12-month implant success in 25 HIV-positive patients with different antiretroviral therapies and obtained positive outcomes regardless of the antiretroviral therapy taken, CD4 count and viral load. However, predictability of the long-term success of dental implants in HIV-positive patients has not been fully documented.[15]

AIM OF THE PRESENT STUDY

This study compared the clinical outcome of dental implants and their implant-supported restorations over a three year period involving patients both positive and negative for the human immunodeficiency virus.

METHODOLOGY

Total 41 patients (Twenty HIV+ and 21 HIV- patients) signed the IRB consent forms for one or multiple single implant placement and restoration. CD4 levels for HIV+ patients were

obtained at regular examination. Diagnostic casts, wax patterns, and radiographic/surgical guides were created. Cone Beam Computer Tomographic (CBCT) images were obtained with radiographic guides in place and analyzed by utilizing 3D CBCT software (InVivo Dental, Anatomage, San Jose, CA) to determine implant placement, size and position. All patients were given either amoxicillin (2 gm) or clindamycin (600 mg) one hour before implant placement and 0.12% of chlorhexidine digluconate antiseptic rinse after implant placement to decrease the chance for bacteremia and implant failure. Root form dental implants, (Astra Tech, DENTSPLY Sirona Implants, OsseoSpeed TX, Moldndal, Sweden) were placed. Implant diameters included 3.0, 3.5, 4.0, 4.5, and 5.0 mm. Implant lengths were 9, 11, and 13 mm. Bone density was evaluated through CBCT software and confirmed at implant placement. Porcelain fused-to-metal crowns (PFM) were given. All patients were placed on 6 months recall for 3 years to assess the periodontal and prosthetic outcomes of implant-supported restorations. Implant stability was qualitatively examined by a sharp tap with mirror handle, and noting the sound produced: either 0- clear ringing sound, digitally stable, or 1-dull thud, unstable. Plaque index ranges from 0 to 2, with 0 (no visible plaque), 1 (plaque detected with probe), or 2 (visible plaque). Gingival index ranges from 0 to 2, with 0 (no bleeding), 1 (bleeding on probing), or 2 (spontaneous bleeding). The Jemt index was used for evaluating the interdental papillae of each implant, with 0 (no papilla present), 1 (less than half of height of the papilla), 2 (half or more of papilla), 3 (the papilla fill the entire proximal space), or 4 (papilla are hyperplastic and cover implant restoration). Statistical analysis for bone loss was performed using SPSS 26 (IBM Corp., Armonk, NY). Analysis was done using mixed ANOVA. The within patients factor was the three years of measurements; the between patients factor being the two groups of patients HIV- and HIV+. Statistical analysis for bone loss was performed using SPSS 26 (IBM Corp., Armonk, NY). Analysis was done using mixed ANOVA. The within patients factor was the three years of measurements; the between patients factor being the two groups of patients HIV- and HIV+.

RESULTS

Among 41 patients, 32 implants were placed in the HIV- group and 27 implants were placed in the HIV+ group. Implant position ranged from central incisor to mandibular 1st molar. Two patients from each group had two stage surgery and the rest were single stage surgeries. CD4 count ranged from 136 to 1273 with mean 603, based on measures provided through the infectious disease clinic; the value was provided only at the beginning of each HIV+ patient's implant study. Bone density was evaluated through CBCT software prior to implant placement and at the implant placement. Implant stability quotients (ISQ) as determined by Resonance Frequency Analysis (RFA) were used as a quantitative measure of stiffness between the interface of bone and implants both at the time of implant placement and definitive impressions. No significant statistical difference ($p>.05$) was found between ISQ values for the HIV+ group. A statistical difference ($p<.05$) was shown for the HIV- group. (Table 1)

Table 1- Summary ISQ values at Implant Placement (i), Restoration Placement (r) and ISQ Difference (Δ r-i) N=16

	HIV (+)		HIV (-)		HIV (+)	HIV (-)
	ISQ i	ISQ r	ISQ i	ISQ r	Δ ISQ r -i	Δ ISQ r-i
Mean	76.7	81.2	72.0	80.6	4.5	8.6
Median	80.0	82.5	74.8	80.0	2.5	5.2
Minimum	60.0	67.0	46.0	70.0	7.0	24.0
Maximum	84.5	88.0	85.5	91.0	3.5	5.5
Range	24.5	21.0	39.5	21.0	-3.5	-18.5

At follow up patient's appointments, implant stability was evaluated with digital movement and tapping with a mirror handle. These were qualitative measurements. None of the restorations demonstrated mobility, pain, or infection. No radiolucency was found on radiographic examination. The mean gingival index (GI) across the three-year period for the HIV- group was 0.127, and was 0.47 for the HIV+ group. Mean plaque index (PI) across three years for the HIV- group was zero. Mean PI across three years for the HIV+ group was 0.29. The Jemt interproximal papilla index was recorded to evaluate the interdental papilla, which has great impact on the implant placed in the esthetic zone. Most of the patients had partial or full interdental papilla filled after one year. The majority of measurements for both groups were in the 2 to 3 range, with no patient measured at 4. The complication rate for implant supported prostheses was 10% in the HIV- group and 16 % in the HIV+ group patients. (Table 2)

Table 2- Percent Gingival Bleeding on Probing (BP), percent of Jemt papilla index (0 - no papilla present, 1 - less than half of height of the papilla, 2 - half or more of papilla, 3 - papilla fill the entire proximal space, 4 - papilla are hyperplastic and cover implant restoration), and Mean 3 Year Gingival Index (GI), Plaque Index (PI)

Year	HIV+							HIV-						
	% of BP	% of papilla index						% of BP	% of papilla index					
			0	1	2	3	4			0	1	2	3	4
1	28	M	0	22	30	48	0	7	M	0	23	44	33	4
		D	0	17	26	57	0		D	0	33	26	41	0
2	45	M	0	22	28	50	0	30	M	0	12	44	44	0
		D	6	11	33	50	0		D	0	16	48	36	0
3	53	M	6	18	29	47	0	8	M	0	28	36	36	0
		D	6	12	35	47	0		D	4	28	28	40	0
Mean 3 Year GI	0.47							0.13						
Mean 3 Year PI	0.17							0						

DISCUSSION

The lack of complications shows that dental implants are a viable treatment for HIV-positive patients. Findings agree with similar reports found in the literature.[16] Previous studies have shown low Bone mineral density (BMD) is common in HIV positive patients, and the frequency varies between 40 and 88%. Low BMD may be related to co-morbidities associated with osteoporosis such as increased age, smoking, low body mass index, or renal failure.[17] According to a study by Chrcanovic, that infection could be one of the causes of implant failure, thus the sinus infection and D3 bone density could be the causes of this implant failure.[18] It should be noted that this patient's contralateral implant was successful. Bone density has been one of the contributing factors in determining the success of implant-supported restorations, but other factors, such as implant design, surgical procedures, and the importance of prosthetic restoration have been recognized.[19] Patient oral hygiene has a close relationship to peri-implantitis. Serino, et al demonstrated that peri-implantitis is associated with inadequate plaque control.[20] Monje, et al confirmed that more regular peri-implant maintenance therapy prevents complications and improves long-term outcomes of implants. [21] Proskin et al, and others developed criteria for evaluating implant survival and success, which included that the implant is in the mouth and functioning, with no pain, no mobility, no infection, and less than 50% bone loss.[22] The results of this study showed that 53 out of 59 implants and restorations met these criteria at first year follow up. For those patients that

returned for subsequent follow up, 47 implants at second year and 42 implants at third year have demonstrated the same positive result. The implant survival rate for HIV+ group was 96% and HIV- group was 100%.

CONCLUSION

Within the limitations of this investigation, implant-supported restorations can be successful on well controlled HIV+ patients at 3 years. Routine dental hygiene prophylaxis should be included as part of the patient protocol when conducting these studies, in part to evaluate the soft tissue response to these therapies.

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