A COMPARISON OF NARROW-PLATFORM (3.0-3.6mm) vs WIDER PLATFORM (3.7-6mm) DENTAL IMPLANTS

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Retrospective research accessing the Electronic Health Record (EHR) of the University of Pittsburgh School of Dental Medicine [axiUm database and software, Exan Group, Las Vegas, Nevada]. The research compared the success (survival) of narrow-platform dental implants (3.0-3.6mm) vs. wider-platform dental implants (3.7-6mm) in the posterior maxilla and mandible (molars and premolars), and, using axiUm measuring tools, evaluated marginal bone loss in each tooth/implant investigated. Datapoints from standard oral radiographs (periapical x-rays) existing in the Electronic Health Record were measured and recorded. Analysis of the data from the Electronic Health Record shows that both narrow and wider-diameter implants will present statistically significant marginal bone loss post-placement and restoration, averaging 0.7mm initial bone loss for the narrow diameter implants and 0.5mm initial bone loss for the wider-diameter implants. These results, from analysis of this existing University of Pittsburgh Electronic Health Record data, may not reflect the success rate anticipated clinically, nor that expected from anecdotal experience.

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PREFACE

Acknowledgements

I would like to extend my deepest gratitude and heart-filled thanks to Dr. Pouran Famili, Dr. Steve Kukunas, Mr. John Close, and Dr. Donald Pipko for their assistance, guidance and patience in completing this project. Moreover, I would like to express my appreciation and love to my parents who live across the ocean and my lovely future wife Dr. Mariam Alassaf who stood by me day after day.

1.0 INTRODUCTION

Dental implants have overall had high success rates, but their placement and restoration still have the boundaries of both biomedical science and art. The history behind dental implants goes back many years. In 600 AD, a young woman missing some of her lower teeth, in the same spirit as any modern woman seeking to have her smile beautified, received one of the world's first dental implants, a kind of prosthesis made from pieces of shells shaped to resemble what looked like teeth. A thousand years earlier, Egyptians nailed copper studs with seashells carvings that looked like teeth. And in the 1930s, dentist Dr. Wilson Popenoe in Honduras made a discovery of ancient Mayan dental implants (1).

The world was introduced to modern endossous dental implants and the titanuim alloy that osseointegrates with bone and forms a strong firm bond by Per-Ingvar Brånemark, a Swedish medical professor, in 1951. Between the Egyptians yet long before Brånemark's fortuitous but almost accidental discovery, were many attempts at developing a replacement for missing teeth. In 1913, one of the first implant systems was introduced by Greenfield in Boston, Massachusetts. In 1939, also in Boston, Strock made solid vitallium screws in root forms for dental implants. But it was the innovation of chrome alloys and alloys in general to dentistry that revolutionized dental implants. Experiments with styling the device continued to evolve, and in 1943 in Germany, Dahl developed his button inserts, which are also known as intramucosal implants (Fig.1). These small metal buttons were placed into the tissue surface of a complete denture facing toward the patient's tissue. Matching holes were surgically formed in the patient's denture-bearing soft tissues at diverging angles (Fig. 2). When the denture was inserted, the buttons engaged and improved the retention. The only problem with this system was that the patient had to wear the denture all the time or the holes in the mucosa would heal closed, and insertion of the denture become impossible or cause ulcerations and discomfort. This system is still available today, but is not very widely used (2).

Goldberg and Gershkoff published their findings regarding subperiosteal implants in 1946. Used in the maxilla or the mandible, the concept of subperiosteal implants is simply placing the metal implant over the bone beneath the periosteum with metal projections emerging out of the soft tissue. These posts are used to retain a complete denture. This system does not require height of alveolar bone, since the implant is placed on existing bone. Success rates for subperiosteal implants are around 90% at five years, 65% at 10 years. Possible risk factors are bone resorption, paresthesia, fracture of the mandible, and soft tissue problems. These are still in use today, but again not widely (2).

In 1953, Behrman and Egan came up with the idea of implanting magnets in patients' jaws to retain complete dentures, which was a failure. The same year, Sollier and Chercheve reported the vertical transfixation implant, or staple implant, as it is now known. This implant is tapped from under the anterior mandible and has three, four, five or seven pins protruding into the mouth. Cowland and Lewis first described the vitreous carbon implant in 1967, basically another failure. In 1969, Linkow designed his blade implant system. The system is still used today very rarely. The blade does not require wide bone to be inserted. Rather it is embedded within the bone and after healing, posts protruding into the oral cavity can be used to retain partial dentures (Fig. 3) (2). The final evolution in implant design before the current Brånemark generation is from Roberts and Roberts, who introduced the ramus implant idea in 1970. The ramus implant is inserted into three locations, the ramus right and left sides and the anterior mandible. The connection between the three points of insertion is made of metal alloy which the complete denture can sit on and use as a retaining mechanism (Fig. 4) (2).

Brånemark and his research team, studying microscopic aspects of bone healing processes in the laboratory at the University of Lund, discovered during one of their experiments that a titanium metal cylinder screwed into the thighbone of a test animal subject had fused with the bone. The amazing discovery phenomenon is now called “osseointegration” which derives from the Greek *osteon*, bone, and the Latin *integrare*, to make whole. The term refers to the direct structural and functional connection between living bone and the surface of a load-bearing artificial implant. From the 1950s to the 1980s, Brånemark published extensively regarding the use of titanium in dental implantology, others further investigated bone biology and the concept of osseointegration, and Brånemark himself entered into a commercial partnership now grown into the dominant figure in the dental implant marketplace, NobelBiocare (3).

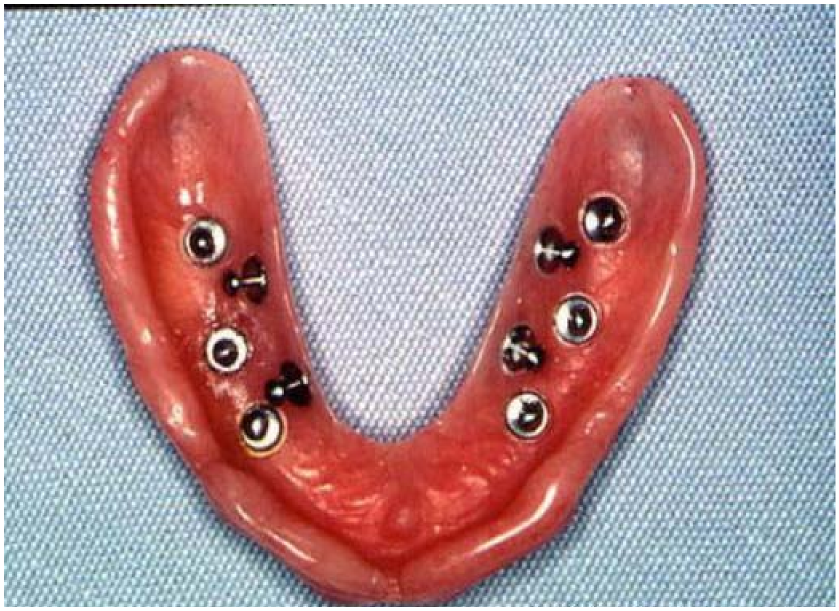


Figure 1: Image **(top)** depicting intramucosal implants. These modern dental implanting devices derive from the fashion of the 1940s-style ‘button inserts’ to retain dentures, as designed and patented by Gustav Dahl.

(Bottom): Intramucosal implants maxillary prosthetic appliance.

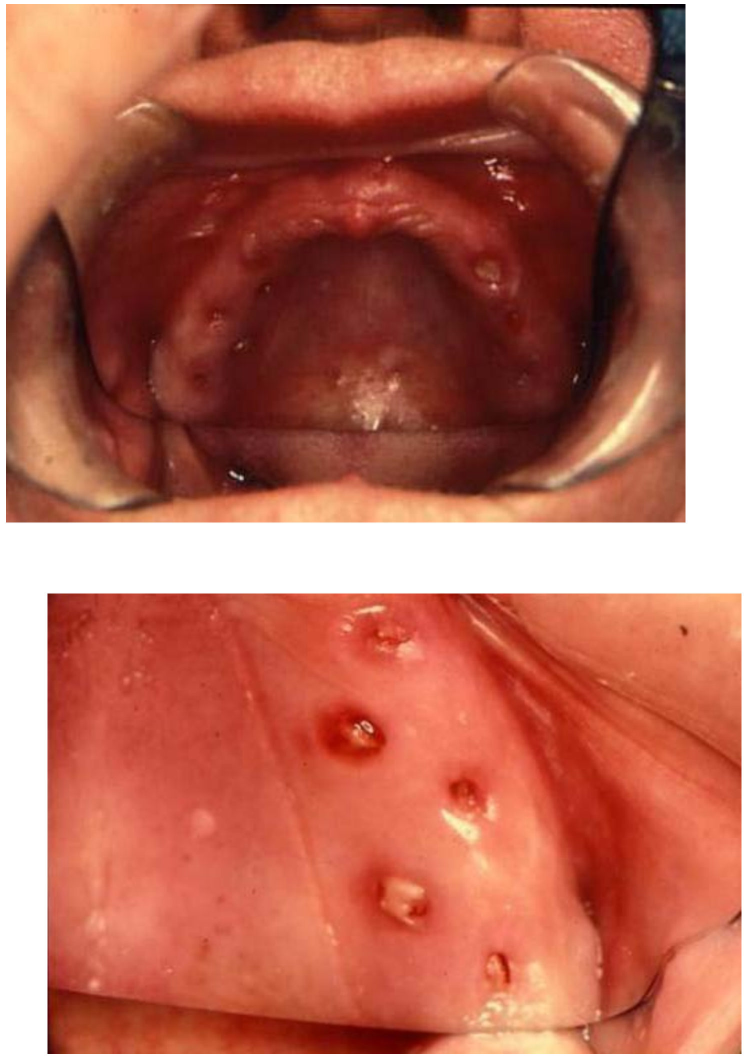


Figure 2: Two views of surgically-formed holes for intramucosal implants.

Figure 3: Image depicting the blade-form implant, as first designed by Leonard I. Linkow in the late Sixties.

Figure 4: Image depicting the ramus blade implant design, as developed in the 1970s by Roberts and Roberts.

2.0 LITERATURE REVIEW

One longitudinal study done by Romeo and Amorfini (4) reports results over a seven-year period, among 122 narrow (3.3mm) implants inserted in 68 patients to support 45 partial-fixed prostheses and 22 single-tooth prostheses, versus 208 standard (4.1mm) implants restored with 70 partial-fixed and 50 single-tooth prostheses. Only six (1.8 percent) of the total 330 implants in that research failed. For narrow implants in that research, the cumulative survival rate was 98.1 percent in the maxilla and 96.9 percent in the mandible. Conversely, regular diameter implants showed a cumulative survival rate at 96.8 percent in the maxilla and 97.9 percent in the mandible. The cumulative survival rates of small diameter implants and regular diameter implants were not statistically significant ($p>.05$).

Retrospective research by Scurria (5) showed that shorter implants and implants with less than 4mm diameter have a decreased survival probability. In five-year prospective research on small-diameter narrow platform (</=3.3) implants reported by the University of Hong Kong (6) merely one implant out of 23 had failed osseointegration.

Another comparison study of length and diameter related to survival at 36 months (among diabetics) (7) showed survival for implants at 3.0mm to be lower than survival for 4.0mm implants. Total overall survival over 36 months for all implants (2,917) placed was 93.1 percent. For 3.0mm diameter implants survival was 92.7 percent; survival for the remaining 4.0mm dental implants was at a rate 4.6 percent greater. The 3.0mm-diameter implants failed earlier and more frequently than the 4.0mm-diameter implants at all stages of clinical function.

Ivanoff (1999) reports on sixty-seven patients ages 16 to 86 in a retrospective study of implant diameter and its relation to implant survival and marginal bone remodeling. In all, 299 Brånemark implants (141 implants at 3.75mm diameter; 61 at 4.0 mm diameter; 97 implants at 5.0 mm diameter) were placed in 16 completely and 51 partially edentulous arches. The failure rate was 5% for 3.75 mm diameter implants (7 out of 141 implants). Two implants failed in the wide-diameter implant group among a total 61 placed (3%). The greatest failure was found in the 5.0 mm diameter implant groups, where the failing rate was 18% (17 out of 97 placed). Ivanoff concludes that less favorable results can be anticipated for 5.0 mm diameter implants than 3.75 mm and 4.0 mm diameter implants (8).

Ahlqvist (1990) studied 50 edentulous jaws during a two-year observation, implant survival rate 89% in maxillae and 97% in mandibles (9).

Zarb and colleagues (1993) reported on 105 osseointegrated implants placed in the posterior region in 46 partially edentulous areas in 35 patients. All but one (40:41) placed in the maxillae (97.6%) remained in function, 59:64 placed in mandibles (92.2%) remained in function, overall survival 94.3% in a loading period from 2.6-7.4 years (mean 5.2 years) (10). In a small retrospective study (11), Zarb and Shin placed sixty four wide-bodied implants in the posterior region of 43 patients and 64 regular-bodied implants (3.75-4.0mm) in the posterior region of 25 of the same patients and 14 others. Interesting results showed an elevated risk of failure with wide-bodied implants. Ten wide-bodied implants failed, with a five-year cumulative survival rate of 80.9%, compared to only two regular -bodied implants failing, for a five-year cumulative survival rate (CSR) at 96.8%.

Four-year controlled prospective clinical research by Vigolo and Cordioli in 2004 (12) reported 100 percent cumulative implant success and no differences with respect to peri-implant marginal bone levels and soft tissue parameters between cemented versus screw-retained implant-supported single-tooth crowns. The data showed a very high rate of success in the restoration of single teeth in the premolar area. The authors suggest in fact that the choice of cementation versus screw retention for single-tooth implant restorations could be expected to be successful in either choice, and primarily a choice of clinician preference.

Vigolo et al (2004) investigated clinical data regarding 2.9mm mini-diameter implants, with results similar to treatment with regular-size diameter implants. The overall survival rate was 94.2% (13).

Pikner and Gröndahl (14) examined 640 patients in retrospective research in 1999. Distance between the fixture/abutment junction (FAJ) and the marginal bone level was recorded. The results showed that the number of implants with a mean bone level of >or=3 mm below FAJ increased from 2.8% at prosthesis insertion to 5.6% at year 1, and 10.8% after 5 years. Corresponding values after 10, 15, and 20 years were 15.2, 17.2, and 23.5%, respectively. Implant-based bone loss was as a mean 0.8 mm after 5 years, followed by only minor average changes. Mean bone loss on patient level followed a similar pattern. Disregarding follow-up time, altogether 183 implants (107 patients) showed a bone loss >or=3 mm from prosthesis insertion to last examination. Significantly larger bone loss was found the older the patient was at surgery and for lower jaw implants. More recent Swedish research by Laurell 2004 (15) examined the marginal bone level after 5-year function, concluding that all implant systems showed a significant amount of marginal bone loss level averaging 0.26 mm annually. The study also suggested a careful documentation of marginal bone loss level should be mandatory on all implant systems being marketed.

Average marginal bone loss was about 0.8mm after five years in function in research by Wennerberg 1999. The study was designed to evaluate 133 patients retrospectively after 5-years function. Overall implant cumulative survival rate was 94% although marginal bone loss continued to increase overall (16).

Flanagan 2008 (17) suggested the use of small diameter implants in compromised, narrow, or restricted sites in the posterior segments of the mandible and the maxilla. His studies analyzed and supported the use of small diameter implants (1.8-3.3mm) in the edentulous area. The study also recommended the splinting technique when the restorative phase comes into place. A small diameter implant poses less of an obstacle for angiogenesis and less percutaneous exposure and bone displacement as compared with standard-sized implants. In posterior sites, rounded and narrow prosthetic teeth present small occlusal tables to minimize axial and off-axial directed forces.

Other factors influence the success rate of implant survival. Marginal bone loss is essential in determining the success or failure of an implant. Research at the University of California Department of Restorative Dentistry showed clearly that other factors are certainly involved affecting implant stability, survival rate and marginal bone loss (18).

In research by Degidi 2008, 510 single small-diameter implants (3.0-3.5mm, 237 patients) were examined retrospectively from 1996-2004. Implant sites included all tooth position and had been functional eight years. Only three implants among the 510 failed, in this research the definition of failure being large amounts of marginal bone loss around the implant platform (19).

3.0 HYPOTHESIS

Narrow-platform implants (3.0-3.6mm) are as successful as wider-platform dental implants (3.7-6mm) in the posterior region (molars and premolars).

4.0 MATERIALS AND METHODS

The research was a retrospective study comparing narrow-platform (3.0-3.6mm) vs. wide-platform (3.7-6mm) dental implants placed at the Multidisciplinary Implant Center of the School of Dental Medicine at the University of Pittsburgh, accessing the Electronic Health Record (EHR) [axiUm database and software, Exan Group, Las Vegas, Nevada].

Inclusion criteria were (1) threaded implant design; (2) area-specific (implant-supported single crowns at tooth positions #2-5, #12-15, #18-21, #28-31); (3) single-tooth non-splinted restorations; (4) the implant placed should be loaded and in function at least one year; (5) the opposing occlusion must be either natural dentition or fixed restorations.

Exclusion criteria were (1) implants placed in grafted sites; (2) immediately-placed implants (single-stage implants); (3) medically-compromised patients, especially osteoporotic patients taking any kind of bisphosphonate medication.

Subjects were divided into two main groups, each group consisting of 90 patients. In general, the implants were placed initially at the height of the crest of the alveolar bone or slightly submerged 0.5mm below the height of the crest of the alveolar bone.

Radiographs (periapical oral x-rays) were reviewed, and the measurements of bone loss around implant platforms recordded. Measurements, by mm, were taken from the height of the crest of the ridge to the first exposed implant thread by using the axiUm measuring tool. The goals of the research were to examine comparative success rates and methodologies; examine the effects of implant selection on success; examine the effects of prosthetic restoration on relative implant success.

Shown below are two images from the axiUm Electronic Health Record (EHR) illustrating the points of the research.

4.1 Sample Case

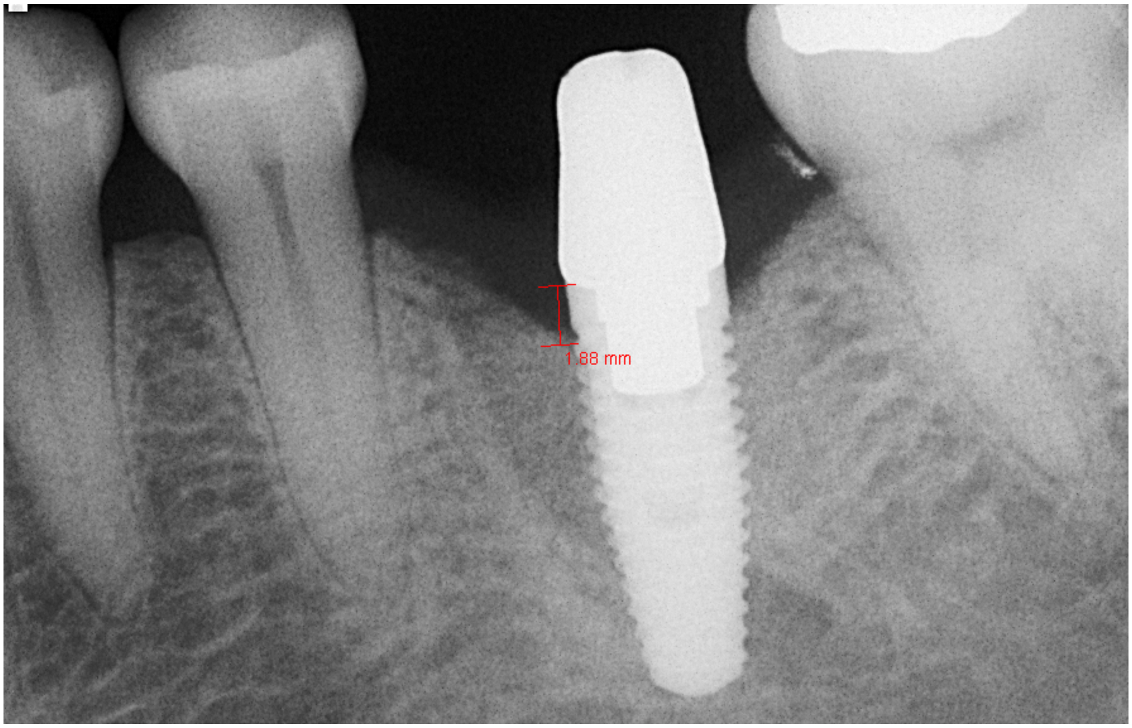


Figure 5: (2009) Regular platform implant (NobelBiocare 4.3 mm diameter) periapical x-ray of a custom abutment try in, average bone loss measured 1.88mm.

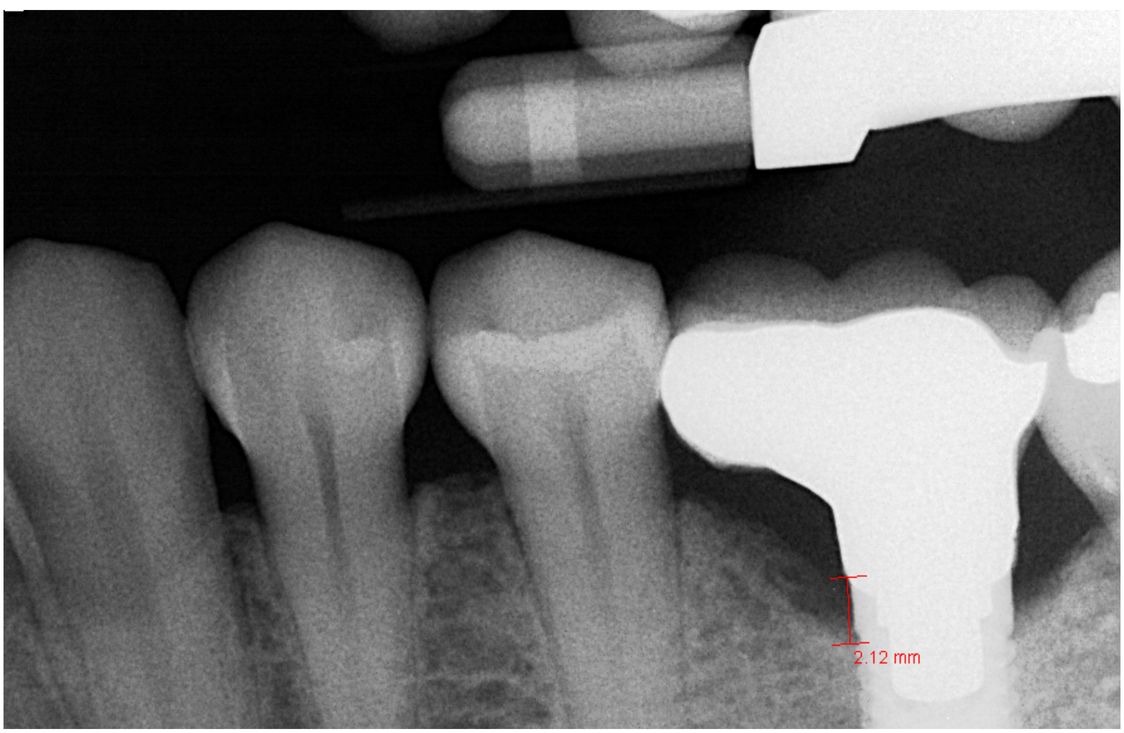


Figure 6: (2011) Same implant measured again (after at least one year in function) for marginal bone loss, measured with an average 2.12 mm.

5.0 DATA AND RESULTS

Each group in the study consisted of 90 random cases examined from the existing EHR at the School of Dental Medicine at the University of Pittsburgh. Radiographs (periapical oral x-rays) of narrow-platform implants (3.0-3.6mm) and wider-platform implants (3.7-6mm) were examined and measured at BASELINE, defined in this research as the time when the implant was about to be loaded (custom abutment try-in). Those same patients with the same implants were also measured at least one year after restoration of the implant. Radiographs were viewed through the axiUm screen and measurements were taken using the axiUm precise measuring tool (axiUm manufacturing information provided above). The collected data was analyzed statistically using a 2x2 Mixed Between-Within Cases ANOVA (simple t test).

Data analysis represented in Table 1. shows two main groups under study, narrow-diameter implants vs. wider-diameter implants over two periods of time. The first (1) represents the time when the implant was about to be loaded (BASELINE) and the second (2) represents the time when the implant was functionally loaded at least one year post-restoration. Each group consists of 90 random cases, specific inclusion/exclusion criteria defined previously. The research displays a statistical power value calculation of 0.851 based on the selected size per group, which makes for statistical significance. Sample size selected for the groups was based on examination of previous studies ranging between 65-70 or more individuals. Data analysis also revealed that narrow-diameter implants have a mean 2.74mm with 0.56mm standard deviation at BASELINE, while regular/wide-diameter implants have a mean 2.53mm with 0.60mm standard deviation at BASELINE, the difference between the two groups being about 0.20mm in mean value and about 0.04mm in standard deviation at BASELINE. After at least one year in function, the narrow-diameter implants have a mean value of 3.36mm with 0.58 standard deviation and the regular/wide-diameter implants have a mean value of 3.05mm with 0.60mm standard deviation. It is clear that after at least one year of implant loading (function), marginal bone level dropped to 0.6mm on average for the narrow-diameter implants and decreased in value for the regular/wide-diameter implants as well, an average value of 0.5mm. The graph represents the predicted pattern of marginal bone loss in the two groups. It is evident that narrow-diameter implants have a steeper graph than the regular/wide-diameter implants. These values are statistically significant but this is not clinically significant.

The implant size-versus-time data analysis (Table 6) shows the upper and lower bounds of 95% confidence intervals (COI). The time-frame analyzed is between (1) the time when the implant is about to be loaded (at the custom abutment try-in). A peri-apical x-ray is taken at that time; and (2) the time when the implant is loaded and in function (occlusion) at least one year post-insertion of the crown. For narrow-diameter implants, the mean value for time (1) was 2.74mm, 95% COI 2.62mm for the lower bound, 2.86mm for the upper bound. The mean value for time (2) was 3.35mm, 95% COI 3.23mm for the lower bound, 3.47mm for the upper bound. Mean values and the 95% COI are lower, explaining the steepness of the graph for the narrow-diameter implants. For regular/wide-diameter implants, the mean value for time (1) was 2.52mm, 95% COI 2.40mm for the lower bound, 2.65mm for the upper. The mean value for time (2) was 2.92mm for the lower bound and 3.17mm for the upper. (Please see Tables 5, 6 and 7).

Table(1): Collected measurements from axiUm

Table (1)

Narrow PF	Implants	3.00-3.6mm	Reg/wide PF	Implants	3.7-6
At baseline	At least 1 yr PR	difference	At baseline	At least 1 yr PR	difference
2.6	3.12	-0.52	2.10	3.11	-1.01
4.53	5.23	-0.70	1.53	2.22	-0.69
2.44	3.12	-0.68	2.18	2.52	-0.34
1.8	2.32	-0.52	2.45	3.37	-0.92
1.91	2.64	-0.73	2.32	2.85	-0.53
2.23	2.94	-0.71	3.83	4.46	-0.63
2.46	3.12	-0.66	3.21	3.75	-0.54
2.72	3.54	-0.82	2.82	3.42	-0.60
1.75	2.62	-0.87	3.12	3.85	-0.73
3.02	3.87	-0.85	2.76	3.34	-0.58
2.83	3.53	-0.70	2.63	3.41	-0.78
2.67	2.98	-0.31	2.94	3.34	-0.40
1.93	2.81	-0.88	2.53	3.16	-0.63
3.25	4.32	-1.07	3.68	4.21	-0.53
2.87	3.57	-0.70	2.87	3.53	-0.66
3.23	3.94	-0.71	1.72	2.36	-0.64
2.76	3.37	-0.61	3.13	3.62	-0.49
2.59	3.24	-0.65	2.52	3.14	-0.62
2.74	3.31	-0.57	1.64	2.06	-0.42
1.79	2.67	-0.88	2.23	2.97	-0.74
2.34	3.07	-0.73	1.23	1.98	-0.75
3.45	4.62	-1.17	1.93	2.57	-0.64
3.72	4.17	-0.45	2.89	3.47	-0.58
2.95	3.72	-0.77	2.85	3.53	-0.68
1.98	2.87	-0.89	1.93	2.67	-0.74
2.36	3.78	-1.42	3.21	3.96	-0.75
3.25	4.05	-0.80	3.62	4.23	-0.61
2.89	3.67	-0.78	2.77	3.21	-0.44
3.67	4.56	-0.89	1.92	2.43	-0.51
2.44	3.2	-0.76	1.46	2.07	-0.61

Table (2): Collected measurements from axiUm

Table (2)					
Narrow PF	Implants	3.00-3.6mm	Reg/wide PF	Implants	3.7-6
At baseline	At least 1 yr PR	difference	At baseline	At least 1 yr PR	difference
2.24	2.87	-0.63	1.97	2.38	-0.41
2.63	3.11	-0.48	2.14	2.79	-0.65
2.42	3.01	-0.59	1.93	2.65	-0.72
3.02	3.76	-0.74	2.03	2.75	-0.72
2.86	3.58	-0.72	2.33	2.78	-0.45
1.98	2.55	-0.57	1.77	2.34	-0.57
3.23	3.87	-0.64	2.23	2.46	-0.23
3.18	3.77	-0.59	1.76	2.03	-0.27
2.97	3.45	-0.48	2.54	3.02	-0.48
2.73	3.45	-0.72	2.31	2.68	-0.37
3.54	4.23	-0.69	2.67	2.98	-0.31
2.88	3.43	-0.55	2.66	3.04	-0.74
3.04	3.74	-0.70	2.84	3.32	-0.48
2.78	3.28	-0.50	2.79	3.32	-0.53
3.09	3.58	-0.49	3.45	3.98	-0.53
2.83	3.21	-0.38	2.61	3.04	-0.43
3.05	3.79	-0.74	2.93	3.43	-0.50
2.96	3.52	-0.56	3.04	3.46	-0.42
2.75	3.07	-0.32	3.42	3.98	-0.56
2.70	3.09	-0.39	2.88	3.36	-0.48
3.08	3.86	-0.78	3.44	3.89	-0.45
2.97	3.27	-0.30	3.25	3.66	-0.41
2.95	3.52	-0.57	2.97	3.34	-0.37
2.99	3.26	-0.27	3.07	3.66	-0.59
3.56	4.21	-0.65	2.64	2.97	-0.33
3.55	4.23	-0.68	3.07	3.28	-0.21
3.27	3.79	-0.52	2.94	3.29	-0.35
2.93	3.48	-0.55	2.39	2.79	-0.40
1.94	2.68	-0.74	3.21	3.58	-0.37
2.62	3.08	-0.46	2.97	3.29	-0.32

Table (3): Collected measurements from axiUm

Table (3)					
Narrow PF	Implants	3.00-3.6mm	Reg/wide PF	Implants	3.7-6
At baseline	At least 1 yr PR	difference	At baseline	At least 1 yr PR	difference
1.24	1.83	-0.59	1.67	2.11	-0.44
3.63	4.14	-0.51	2.54	2.98	-0.44
2.79	3.24	-0.45	2.93	3.23	-0.30
2.02	2.76	-0.74	1.03	1.67	-0.64
2.86	3.28	-0.42	2.33	2.78	-0.45
1.93	2.31	-0.38	1.77	2.23	-0.46
2.27	2.89	-0.62	2.21	2.89	-0.68
2.10	2.46	-0.36	1.76	2.12	-0.36
2.58	3.08	-0.50	1.54	1.99	-0.45
2.33	2.78	-0.45	1.31	1.98	-0.67
3.86	4.43	-0.57	2.97	3.53	-0.56
2.27	2.76	-0.49	2.66	3.03	-0.37
3.08	3.63	-0.55	2.94	3.43	-0.49
1.78	2.32	-0.54	1.79	2.15	-0.36
3.03	3.67	-0.64	3.45	3.97	-0.52
2.68	3.12	-0.44	2.61	3.07	-0.46
2.39	2.87	-0.48	2.23	2.76	-0.53
1.96	2.65	-0.69	2.04	2.33	-0.29
2.67	3.04	-0.37	2.42	2.76	-0.34
2.97	3.43	-0.46	2.67	3.11	-0.44
3.04	3.51	-0.47	3.14	3.57	-0.43
2.55	2.97	-0.42	2.25	2.88	-0.63
2.94	3.42	-0.48	2.78	3.21	-0.43
2.63	2.98	-0.35	2.07	2.67	-0.60
3.21	3.64	-0.43	2.56	3.19	-0.63
3.68	4.04	-0.36	3.07	3.79	-0.72
3.23	3.78	-0.55	2.94	3.42	-0.48
1.93	2.54	-0.61	1.79	2.32	-0.53
2.94	3.62	-0.68	3.21	3.79	-0.58
2.53	3.12	-0.59	2.67	2.98	-0.31

Table (4): Descriptive Statistics

	Implant Size	Mean	Std. Deviation	N
Baseline	Narrow	2.7448	.55945	90
	Regular or Wide	2.5291	.60387	90
	Total	2.6369	.59044	180
1 Yr or more	Narrow	3.3558	.58488	90
	Regular or Wide	3.0477	.60425	90
	Total	3.2017	.61278	180

Table (5): 95% Confidence Interval Bounds. Implant Size

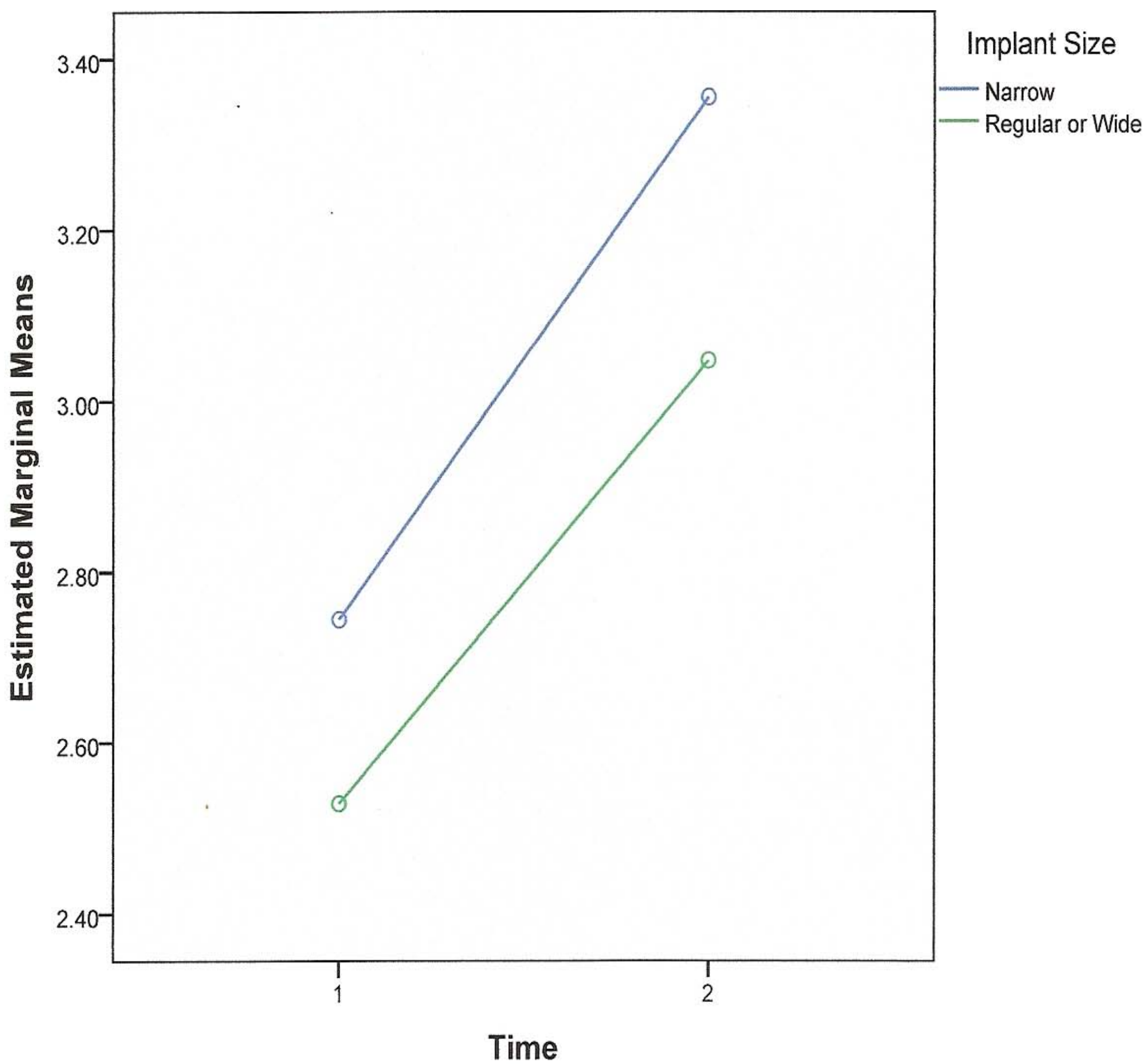
			95% Confidence Interval	
Implant Size	Mean	Std. Error	Lower Bound	Upper Bound
Narrow	3.050	.061	2.929	3.171
Regular or Wide	2.788	.061	2.667	2.909

Table (6): 95% Confidence Interval Bounds. Time

			95% Confidence Interval	
Time	Mean	Std. Error	Lower Bound	Upper Bound
1	2.637	.043	2.551	2.723
2	3.202	.044	3.114	3.289

Table (7): 95% Confidence Interval Bounds. Implant Size : Time

				95% Confidence Interval	
Implant Size	Time	Mean	Std. Error	Lower Bound	Upper Bound
Narrow	1	2.745	.061	2.624	2.866
	2	3.356	.063	3.232	3.479
Regular or Wide	1	2.529	.061	2.408	2.650
	2	3.048	.063	2.924	3.171



Graph (1): Marginal Bone Loss vs. Time

The graph represents the estimated values over time with respect to implant diameter size. Key: (1) stands for the time when the implant was about to be loaded (custom abutment try-in). (2) stands for the time when the implant was loaded and at least one year in function (occlusion). Notice the steepness of the curve representing the narrow diameter implant.

6.0 DISCUSSION

The foundation of any structure or building has to be solid and architecturally sound to withstand any exerted force from any direction. The bioengineering of dental implants have always favored wide diameter dental implants. Logic says the wider the surface, the better tolerance of withstanding forces exerted on the crown, which extends to the dental implants. Major dental advancements have led dental implants to remarkably high routine success rates. Advancements in technology have introduced the ability to restore severely compromised sites such as knife edge boney structures or those with minimum boney volume bucco-lingually. Expectations for narrow diameter dental implants have flourished due to their improved success.

Results of this study show that narrow diameter dental implants can indeed be used in the posterior area when boney volume is minimized. The results are close in value between the two major groups and statistically significant. The difference between mean values at BASELINE is 0.20 mm, 0.04 mm for the standard deviation. In other words, the healing process for narrow-platform and the regular/wide-diameter implant is very similar. However, after at least one year of function the gap between the values widened. The narrow-diameter dental implants have a mean value of 3.36mm with 0.58mm standard deviation whereas the regular/wide-diameter dental implants have a mean value of 3.05mm with 0.60mm standard deviation. The marginal bone level dropped to 0.60mm on average per year after at least one year of functional loading.

It was evident that the rate of bone loss for the two groups was consistent, with a slight elevation of bone loss observed in the narrow-diameter dental platform. In addition, both groups had upper and lower bounds for 95% confidence intervals ranging from 2.40mm to 3.20mm.

Recent studies have shared similar results showing the ability of narrow-diameter dental implants to restore such areas. Romeo and Amorfini (4) have shown a draw between narrow-diameter and regular-diameter implant success. Research by Cordioli et al (2004) showed relatively good success for narrow-diameter implants in the restoration of single teeth in the premolar area (12). Flanagan 2008 (17) also suggested the use of small diameter implants in compromised, narrow, or restricted sites in the posterior segments of the mandible and the maxilla. His studies analyzed and supported the use of small diameter implants (1.8-3.3mm) in the edentulous area. A small-diameter implant is a less of an obstacle for angiogenesis and there is less percutaneous exposure and bone displacement as compared to standard-sized implants. Most new research and literature support and confirm the results in this study.

7.0 CONCLUSION

This research presents clear evidence of the success of the narrow-diameter dental implants restoring posterior edentulous area in the maxilla and the mandible. The data is statistically significant. The rate of bone loss around the narrow-diameter dental implants is slightly higher than the rate of bone loss around regular/wide-diameter dental implants. This may or may not have a direct clinical impact. In other words, those values are statistically significant but clinically not significant. To confirm these preliminary findings and indications, further prospective future research is necessary.

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