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RELATIONSHIP BETWEEN IMPLANT LOCATION AND FREQUENCY OF REQUIRED PROCEDURES

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ABSTRACT:

Aim: Understanding and foreseeing the possible additional or ancillary procedures that may be required for successful implant placement in a particular location or region of the jaw could contribute to better preparation and accurate prognosis.

Materials and method: This retrospective study has been derived based on an analysis of 200 randomly selected cases. Each procedure during implant treatment was categorized and coded as follows: 1: Surgery & Restoration, 2: GBR(Guided Bone Regeneration), 3: GTR(Guided Tissue Regeneration), 4: Block Bone graft, 5: Spreading, 6: Splitting, 7: Internal Sinus, 8: External Sinus, 9: PRF(Platelet Rich Factor). Each of the 200 cases was examined in detail and the number of additional procedures was calculated. The zones are described as five alveolar jaw regions - anterior mandible (Z1), posterior maxilla (Z2), posterior mandible (Z3), anterior maxilla (Z4), and posterior maxilla with sinus lift involvement (Z5).

Results: The average number of procedures performed was Z5- 3.00, Z4- 1.92, Z3- 1.56, Z2- 1.78 and Z1- 1.

Discussion: There is a consistent trend of decrease in the number of additional procedures from Z5 to Z1. The estimated maximum is in the posterior maxilla, followed by anterior maxilla, posterior mandible, maxillary premolars and anterior mandible.

Conclusion: Implant location can indicate / implicate the number of ancillary procedures that may be required for a successful treatment in different jaw zones. A thorough understanding of specifics of each zone clinically should help to improve preparation for treatment steps and prevent unexpected complications during treatment with dental implants.

Key Words: Ancillary procedures, implant success, implant failure, jaw accessibility, healing time, implant location

INTRODUCTION:

The causes of early implant failures during the osseointegration process include poor quality and quantity of bone and soft tissue [1–8], patient's medical condition [2,6,8–10] ,unfavorable habits (bruxism, heavy long-term smoking, poor oral hygiene, others) [3,4,6,8,11] , inadequate surgical analysis and technique [3,7–9,11] inadequate prosthetic analysis and technique [3,7,8,11–13] ,suboptimal implant design and surface characteristics [6,9,13], implant position or location [14] and unknown factors.

This article attempts to further investigate implant location as one of many factors in early stages of diagnosis

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that can predict the number of ancillary (additional) procedures that may be required to complete the treatment.

Five zones (Z1 to Z5) is categorized and adopted to better analyze implant procedure preparation during diagnostic phase based on the location. This article identifies all possible ancillary procedures in different alveolar jaw regions prior, during or after implant placement and accordingly facilitates dental implant placement with better understanding of what to expect.

Z1-Z5 locations are related to the bone quality classification of Lekholm & Zarb.[15] The five zones identified are: Anterior mandible (Z1) with unique characteristics of anatomy, blood supply, pattern of bone resorption, Posterior maxilla (Z2) with different form of bone quality and quantity, Posterior mandible (Z3) with unique and high risk anatomical structures, Anterior maxilla (Z4) with a need for soft and hard tissue grafting and other ancillary procedures, and Posterior maxilla with sinus lift involvement (Z5) a location highly delicate due to communication with the respiratory mucosa.

MATERIALS AND METHODS:

200 files were randomly selected and accordingly classified from a data base of 1134 patients who had successfully received 4800 dental implants from 2001 till 2015. The patients in the first 100 files (sample 1) were exposed to both Panoramic and Cone beam computed tomography (CBCT) and those in the second 100 files (sample 2) were exposed to only panoramic radiograph during their diagnostic visit.

Number of procedures: Each procedure during implant treatment received a code as follows: 1: Surgery & Restoration, 2: GBR, 3: GTR, 4: Block Bone graft, 5: Spreading, 6: Splitting, 7: Internal Sinus, 8: External Sinus, 9: PRF. Each of the 200 cases was examined in detail and the number of procedures added for every case was divided by the number of cases included in that category to get an average number of procedures per class.

Statistical Analysis

An inferential and qualitative Statistical analysis was done by computing and using Sample means, Sample Standard Deviation. Students' T Test is used to compare means and proportions, inference given on the basis of value of P (Statistical significance difference was denoted when $P < 0.05$).

The Mann-Whitney test is used to compare differences between independent classifications under minimum, maximum and average of HFU and time.

One Way ANOVA is used to find significant difference between CBCT and PAN.

Statistical Observations

Test Statistic -2.6933 (ratio between the difference to the standard error)

P Value < 0.05 (p = 0.00714)

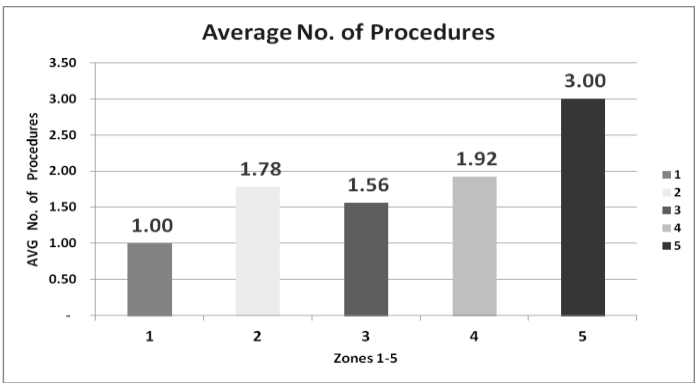
The *t-statistic* is a ratio of the departure of an estimated parameter from its notional value and its standard error.

RESULT:

Zone (1 -5)	Sum of No. of Procedures (Sample 1)	No. of Cases (Sample 1)	Average No. of Procedures per Level (Sample 1)	Sum of No. of Procedures (Sample 2)	No. of Cases (Sample 2)	Average No. of Procedures per Level (Sample 2)	Average No. of Procedures per Level (Sample 1&2)
1	14	14	1.00	4	4	1.00	1.00
2	37	19	1.95	47	29	1.62	1.78
3	53	33	1.61	47	31	1.52	1.56
4	65	31	2.10	49	28	1.75	1.92
5	9	3	3.00	24	8	3.00	3.00
Total	178	100		171	100		

Table 1. Average No. of additional procedures per Zone (Sample 1 and 2) required to complete the Implant procedure.

Chart 1



The data in Table -1, relating to the number of procedures in each class, demonstrated that out of 200 samples Class V- required an average of 3.00 ancillary procedures for each implant, followed by Class IV that required an average of 1.92 procedures, class III- an average of 1.56 procedures, class II- an average of 1.78 procedures and class I- 1 procedure, respectively.

Statistical Inference

Average	1.780	1.710
STD	0.848	0.743

Test Statistic 0.62 (ratio between the difference to the standard error)

P Value 0.54 0.57

There is no significant difference between number of Procedures performed with CBCT and with PAN.

Individual Verifications

Mann Whitney Test showed evidence of Statistical Significant Difference between Classifications 1 and 2 ($P < 0.001$)

Mann Whitney Test showed evidence of Statistical Significant Difference between Classifications 1 and 3 ($P < 0.001$)

Mann Whitney Test showed marginal evidence of Statistical Significant Difference between Classifications 1 and 4 ($P = 0.0495$)

Mann Whitney Test showed evidence of Statistical Significant Difference between Classifications 1 and 5 ($P < 0.001$)

Mann Whitney Test showed evidence of Statistical Significant Difference between Classifications 2 and 3 ($P < 0.001$)

Mann Whitney Test showed marginal evidence of Statistical Significant Difference between Classifications 2 and 4 ($P = 0.05215$)

Mann Whitney Test showed evidence of Statistical Significant Difference between Classifications 2 and 5 ($P < 0.001$)

Mann Whitney Test showed evidence of Statistical Significant Difference between Classifications 3 and 4 ($P < 0.001$)

Mann Whitney Test showed evidence of Statistical Significant Difference between Classifications 3 and 5 ($P < 0.001$)

Mann Whitney Test showed evidence of Statistical Significant Difference between Classifications 4 and 5 ($P < 0.001$)

Overall, there is a significant difference between each classification ($P < 0.001$)

DISCUSSION:

There are few literature reports that attempt to study implant location, among a multitude of other factors, to determine its influence on the success or failure of dental implant treatment. Becker et al [16] in a prospective study evaluated 282 implants placed in the maxillary and mandibular molar positions. The 6-year cumulative success rate (CSR) for maxillary posterior implants was 82.9%, for mandibular posterior 91.5%. He concluded that CSR in the posterior regions is lower than usually reported for anterior regions of the maxilla and mandible due to differences in bone quality and quantity. Eckert et al [17] in a retrospective study assessed 1170 endosseous implants placed in partially edentulous jaws: anterior maxilla, posterior maxilla, anterior mandible, and posterior mandible. In his report, location of implants did not appear to have any effect on implant survival, implant fracture rates, screw loosening, or screw fracture. Parein et al [18] in a long-term retrospective study analyzed 392 consecutively placed Branemark implants that were inserted in 152 partially edentulous posterior mandibles

and restored with 56 crown and 168 bridge restorations. The CSR of all implants in the posterior mandible was 89.0% at 6 years. Fewer complications were found in implant prostheses located exclusively in the premolar region versus molar and mixed molar-premolar implant restorations. Drago [14] investigated the location-related osseointegration of 673 implants placed in 169 patients that were observed from 7 months to 8 years following occlusal loading. Implant osseointegration was 89.1% in the anterior maxilla, 71.4% in the posterior maxilla, 96.7% in the anterior mandible, and 98.7% in the posterior mandible. Moy et al[19] analyzed implant failure rates and associated risk factors, observed implant failure of 8.16% in the maxilla and 4.93% in the mandible. Increased age (over 60) was strongly associated with the risk of implant failure. Bass et al [20] evaluating 303 patients with 1097 implants over 3-year period, assessed the success rate of implants in the maxilla at 93.4% and 97.2% in the mandible. Poor bone quality played the major role in implant failure rate with bone quantity demonstrating less importance. All presented reports appear to agree that the CSR of dental implants is generally high and that implant location plays an important role in implant success. CSR of implants in the mandible seems to be slightly higher than in maxilla—about a 4% difference. The success rate of implants in the anterior regions seems to be higher than in the posterior regions of the jaws, mostly due to the quality of bone: about 12% difference between anterior maxilla and posterior maxilla, and about 4% difference between anterior mandible and posterior mandible. On the basis of reviewed literature reports, implant treatment in the anterior mandible appears to be the most successful. The posterior maxilla appears to be the least successful region of the jaws for implant rehabilitation. In this study one explanation for the small difference or shift in the sequence between Zone 2 and Zone 3 is that 16% of maxillary 1st premolar region (Z2) received a very small GBR procedure as compared to only 13% of the posterior mandible (Z3).

CONCLUSION:

There is a consistent trend of decrease in ancillary procedures (Z5 to Z1) that can be pre-estimated according to the location in different areas in the oral cavity. The estimated maximum is in the posterior maxilla (sinus region), followed by anterior maxilla, posterior mandible, maxillary premolars and anterior mandible.

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