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RATIONALITY OF RIDGE MAPPING TO ASSESS THE BUCCO-LINGUAL WIDTH OF THE ALVEOLAR BONE – A REVIEW.

Dental Science

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ABSTRACT

Aim: To review the validity of Ridge Mapping technique as reliable method to assess the bucco-lingual ridge width prior to implant placement.
Materials and Method: The literature search was done electronically and also hand searched with the terms such as Ridge Mapping, Alveolar Ridge Width, Implants and Bucco-Lingual Width. The search was limited to full text articles which are published in English language only. The search was performed through Medline and Google. A total of 85 articles were found and out of these 66 were not related to present search and hence were excluded from the study. Finally 19 articles were found to be relevant.
Results: All the techniques having some advantages and disadvantages with reliable results.
Conclusion: The results of the study showed that, the Ridge Mapping is a reliable, simple and easy to perform at chair side technique to assess the bucco-lingual width of the alveolar ridge.

KEYWORDS

Alveolar Ridge Width; Implants; Ridge Mapping; Bucco-Lingual Width.

INTRODUCTION:

Accurate evaluation of alveolar ridge dimensions is necessary for the long term success of the implant.At least 1mm bone width should be available adjacent to the implant, where as in the esthetic region 3mm of bone should be required throughout the osseo-gingival relationship, to reduce gingival recession.[1] Different authors described different methods for assessing the alveolar ridge width prior to implant placement, such as CBCT, Linear Tomography, Ultrasonography, IOPA in Occlusal Projection, Ridge Mapping (RM) and Gold standard Direct Surgical Exposure technique(G.S.D.S).[2,3,4,5,6,7,8,9]

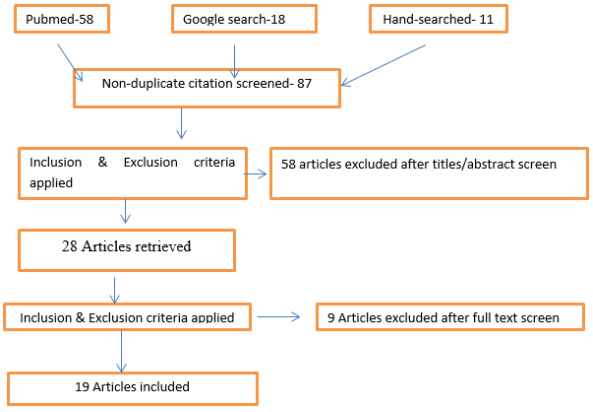
The edentulous ridge site having 3 dimensions, they are length, width and depth. The mesio-distal dimension is the length, the Bucco-lingual is the width and from the crest of the ridge to the adjacent limiting anatomic land mark is the depth.To keep soft tissue level stable, the bone width should be greater than 1mm present on either side of the implant facio lingually, especially in the facial side problem of bone resorption may lead to esthetically unacceptable condition. In an ideal situation the implant width at least 3mm less than the bucco-lingual dimension of the bone. Knowing the physical measurements of the existing alveolar bone prior to implant surgery is a key aspect in the treatment planning.[10] The IOPA and Panoramic radiographs are 2-D in nature, and will not divulge the details on the sagittal bone morphology.[8,11,12], whereas with three-dimensional imaging evaluation of both quantity and quality of bone as well as important anatomical structures, but having some disadvantages like radiation, image production time, images of metallic tooth restorations distorts and economic burden to the patient.[8]

The CBCT can be more helpful in the area where the vestibular depth is insufficient and ridge mapping is not practicable, where the ridge height is less, anterior ridge concavities present in the maxillary anterior region and high lingual frenum present. But CBCT having some disadvantages like if any metal restorations present, then it iscompletely not dependable method, also if any tiny change in the width of the alveolus may not display notable on the scan. The CT scan is more useful in restricting the bucco-lingual position of the inferior dental nerve.

Contrarily to get control of the constraints of the conventional radiography, alternative clinical techniques have been invented to calculate transversal alveolar bone such as Ridge mapping technique.[6,7,8] Ridge mapping can assess the bucco-lingual dimension of the ridge. It can provide immediate details and is a chair side procedure. Wilson DJ et al., [6] and Traxler et al., [4] advocated the technique of measuring the ridge width with specially designed caliper. The proponents of Ridge Mapping technique claimed that, this is an authenticated procedure for evaluating appropriability of probable site for implant. Having some draw back that, if the overlying mucosa is extremely thick then the results may vary and manual error of applying the uniform pressure while measuring may also be consider.[4]RM is uncomplicated and useful method to assess the thickness of the bone, RM required LA but it is not a factor for most patients.[6]The direct surgical exposure method is a 'gold standard' because the actual measurements of the bone can be made with calipers after exposure of the mucoperiostium.[7, 8]. In the literature different studies mentioned different techniques to assess the width of the alveolar bone prior to implant placement along with some disadvantages. Out of all the techniques the proponents of RM technique claimed that it is a simple, chair side and reliable technique with fewer complications. Hence the aim of this research study is to furnish upfront information regarding the rationality of RM for the determination of edentulous ridge measurements for pre surgical implant treatment procedure.

Methodology:

The literature search was done electronically and also hand searched with the terms such as Ridge Mapping, Alveolar Ridge Width, Implants and Bucco-Lingual Width. The search was limited to full text articles which are published in English language only. The relevant papers and identified articles from the reference list were also assessed. The search was performed through Medline and Google between January 2016 and March 2019.A total of 85 articles were found and out of these 66 were not related to present search and hence were excluded from the study. Finally 19 articles were found to be relevant. The strategy of search is mentioned in flow chart.



Ridge Mapping Method:
For alveolar bone width measurements using RM method, in the literature different researches suggested different instruments and materials. Some suggested use of Ridge mapping Caliper [Wilson DJ 1992, Traxler M et al 1992, Ten Bruggenkate CM et al 1994, Allen F et al 2000], modified caliper [Sven Jisander 1996], using no 25 K endodontic file [Chandraker NK 2013,Chug A 2013 and Dave BH 2017].For RM technique, on the diagnostic cast at edentulous area a clear acrylic resin stent should be prepared with reference points, which can be visible over the stent. A total of 5 points will be marked with the gap of 2mm, one point on the crest and two points each in the buccal and lingual sides of the ridge, then 1mm diameter hole will be made at each reference point with a straight bur may produce harmonious buccal and lingual locations for proper estimation of width of the ridge. Later the edentulous area of the cast will be sectioned perpendicular to the ridge. Then the local anesthetic solution will be administered then the acrylic stent will be placed intra orally at edentulous area. An endodontic K file, size no.25 with a rubber stopper will be used to penetrate through the oral mucosa until the bone will be reached and the stopper will imprecise in near contact with the stent. Then the stent along with the needle and stopper removed from the oral cavity and placed on the sectioned model cast. The deepness of the file will be marked on the cast. Like this a total of 5 areas will be marked and transferred on to the cast. Later all the dotted lines will be joined which will give the exact width of the available bone (Fig-1.A, 1.B,1.C).

DISCUSSION:
Thorough knowledge regarding the alveolar bone dimensions and appropriate treatment planning is needed for ideal placement of implants, because in course of surgery, treatment plan is not possible to change.[13] The panoramic and or periapical radiographic assessment of alveolar bone width is in two-dimensional form only. The most routine additional test used for pre surgical evaluation of dental implants by means of conventional radiographic method, but there are some drawbacks with these techniques such as overestimation/sub estimation or elongation /shortage of the image compared with the original ridge dimensions.[14,15]

We can get the three dimensional information with Computed tomography.[16] The three –dimensional techniques which includes CT, can furnish a handy diagnosis. The results are accurate compare with other radiographic methods. Apart from its quantity of radiation, financial burden, metal markers should be avoided due to its 'scattering effect' on the image.[17]The CBCT exhibited as reliable tool for pre-surgical planning with some of the superior qualities like, large decrease in radiation dosage, very good resolution as well as a promising diagnostic quality, but having some limitations like, cost, lack of availability of this facility in many areas of the world.[18] Amarnath GS et al., revealed from their cadaveric study that CBCT shown slight overestimation of the bone dimensions compared to direct measurements.[19] According to Schropp L et al., Conventional CT is $2^{1/2}$ times more accurate than the panoramic and IOPA.[20]

For the operator before performing the surgery the thickness of the alveolar bone can be furnished by RM Technique. These details can intercept the surgeon an abrupt modification in the treatment plan while performing the surgery, if inadequate availability of the bone to place an implant. [10] According to Chandraker et al., anterior maxilla the availability of bone for ridge mapping which can keep away the problems encountering with the CT scanning.[12] Ridge mapping calipers can be skillful for the assessment of alveolar bone measurements. The proponents of RM calipers was Wilson DJ (in 1989), Traxler M et al., (1992) and ten Bruggenkate (in 1994) mentioned that RM is a good dependable technique suitable to perform at chair side with immediate results.[2,4,6,7 8] Perez LA et al., concluded from their human cadaveric study that in relation to posterior mandibular ridge width both RM and LT have shown under estimated measurements.[3]

According to Chug A et al., and Chen et al., the results of ridge mapping and surgical exposure are same.[11,16] But as per the study results of Perez LA et al., no significant difference between R.M & Linear tomography found.[3] According to Traxler M et al., the ultra sound measurements and RM with Wilson's bone caliper measurements are almost same and mental foramen can be exactly identified with ultra sound method.[4]

The 'gold standard' technique [G.S.D.S] is a direct surgical exposure technique, which is very accurate one. As per Castro-Ruize CT et al., there was no statistical significance between gold standard direct surgical ridge exposure, RM and CBCT.[14] whereas as per Chen et al., there was a difference between G.S.D.S and CBCT but not among GSDS and RM.[11] But according to Luck et al., there is difference in RM & CBCT.[21] According to Gonzalez Cortes A R et al., CBCT shown more accuracy than direct caliper technique and more reliable than LT, but in a single site produces less radiation than the CBCT.[22]

Conclusion: The diameter of the implant should not exceed the measurement of the host bone, for the long standing favorable outcome. To reach this perfectly precise bone dimensions should assess prior to surgery is very crucial.Sometimes it is very frustrating situation to the surgeon that after the bone site exposure, the real bone measurements will not be acceptable and in this situation the treatment may be deserted. To overcome this problem apart from utilizing the manoeuvre technique; ridge mapping can also be used to assess the alveolar crest width prior to implant placement. Though it is simple, easy to perform at chair side, having some disadvantages such as the direction of the needle, which is always not consistent.

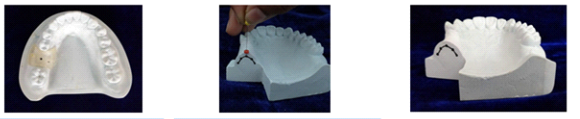


FIG-1.A.STENT WITH GUIDING HOLES FIG-1.B.TRANSFERRING ON TO THE CAST FIG-1.C.COMPLETED RIDGE MAPPING

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