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Short Communication

An efficient three dimensional universal guide for accurate placement of mini implants

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ABSTRACT

Anchorage refers to the resistance against displacement by anatomical structures and the control of anchorage is one of the main factors for determining the success of orthodontic treatment. Conventional means of anchorage system were extra-oral and intra-oral anchorage. Evolution of intra-oral skeletal anchorage provided "Absolute Anchorage" using dental implants, miniplates and mini implant for fixed appliances which demanded stationary type of anchorage. Success of orthodontic mini implant depends on root proximity of the screw, cortical bone thickness and placement angle. In this article, we have described a grid for site selection and a well designed standard placement guide to prevent the root proximity while insertion, and reduce the chance of implant failure.

1. Introduction

Anchorage refers to the resistance against displacement by anatomical structures and the control of anchorage is one of the main factors for determining the success of orthodontic treatment.[1] Conventional means of anchorage system were extra-oral and intra-oral anchorage. Extra oral anchorage was required to negate the forces generated by the intra-oral fixed appliances. Intra-oral anchorage methods were used for 24 hours, but encountered some percentage of anchor loss. Evolution of skeletal anchorage provided "Absolute Anchorage" using dental implants,[2] miniplates[3] and mini implant[4] for fixed appliances which demanded stationary type of anchorage. Titanium mini implant are currently in trend because of their use in various complex tooth movement, minimal anatomical limitations for placement, minimum tissue destruction, low cost and simpler placement.[5] Placement of the mini implant should be in the keratinized gingiva as placement in non-keratinized gingiva leads to formation of hypertrophic tissue formation and inflammation,leading to failure of the mini implant.[6,7]

Success of orthodontic mini implant depends on root proximity of the screw, cortical bone thickness and placement angle. For prosthetic implants, 3mm between the adjacent root and implant surface is recommended for integration and proper health of the tooth.[8] Till date no data is published regarding minimum distance between the mini implant and the adjacent tooth root surface. Hence, mini implant should be maximum away from the adjacent tooth root surface.[5]

Precise selection of mini implant is important for its stability. Placement of mini implant is inter-radicular therefore it should be thinner in diameter, but in order to increase the surface area for stability the length of the mini implant is increased. As reported by Poggio et al , the "Safe Zones" for the placement of mini implants in maxilla are mesio-distally between the second and first premolar palatally, and buccopalatally between the first and second premolar. In mandible, mesiodistally the greatest amount of bone was found between first and second premolar; and least at first premolar and canine region. Buccolingually the thickness is more at first and second molars while least at

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first premolar and canine, thus these sites are suitable for implant placement.[9] The thickness of gingiva must also be considered for selection of mini implant, to determine the length of the neck.[10]

Increasing the vertical angulation of mini implants by 30^o during placement increases the cortical plate contact by 1.5 times than by placing perpendicular to the cortical bone.[11] Increasing this placement angle will increase the contact with the cortical plate.[12] According to Zhao et al, a placement angle of $50^o$to 70^o gave best stability.[13] However, El-Beialy et al statistically reported no significant result with vertical placement angle and the implant success.[14] The stability of the mini implant also increases with age above 18 years and in males as reported by Fayed et al.,[15] due to increase in cortical bone thickness.

A 1 mm of clearance of alveolar bone is required for periodontal health of the adjacent tooth from the surface of the mini implant. Thus a minimum of 3 mm of inter-radicular bone is required for the placement of 1 mm diameter of mini implant.[9,16]

1.1. Complications of mini implants

1. Mobility of mini implants
2. Proximity of tooth root
3. Oro-antral communication
4. Peri-implantitis
5. Undesirable tooth movement
6. Mini implant fracture
7. Mini implant slippage[17]
8. Nerve involvement[17]

Among the above mentioned complications the proximity of the tooth root to the mini implant surface is utmost important for the stability of mini implant. Hence, the implant must be inserted in a predetermined angulated position and path to avoid root proximity and failure. Several grids and guides have been designed for placement of mini implants,[18–20] but this appliance is much more accurate for site selection and pre determined angulation of mini implant insertion.

2. Method of construction

Three dimensional universal guide consists of

2.1. A metallic grid for site selection (Figure 1)

The grid was fabricated using 0.7mm round stainless steel wire. The dimension of grid were 10 x 10 mm into which 4 horizontal and 4 vertical wires were welded. A vertical arm through the middle was used for the attachment between the base arch wire and grid. This base arch wire (0.019 x 0.025) passes through the slots of the brackets and tubes.

2.2. Implant positioning guide (Figure 2).

Guide is fabricated using a jackscrew, one guiding pin of the jackscrew is cut. A 1 mm wire is used for the formation of the 2 helix guide (internal diameter 6 mm) and transverse arm (length 10 mm), the 2 helices must be unicentric and symmetrical (for confirmation hold the appliance at one hand distance such that when seen from one helix the other helix should not be visible). Solder this appliance to the jackscrew on one side and on other side weld a 0.019 x 0.025 inch base arch wire so as to position the guide. The proximal view shows the central driving shaft and the angulated helices with soldered arch wire (Figure 2b).

3. Method of placement

The steps for implant placement are as follows,

1. Initial levelling and alignment must be accomplished for the placement of grid and guide.
2. Infiltration with local anaesthesia
3. Place the grid in position with the horizontal base wire in bracket slots securely (Figure 3) and shoot an IOPA for that region with angulation less than 10^0 from ideal. This angulation was chosen because with ideal angulation the grid was observed more occlusally on IOPA, hence to get higher accuracy for the implant placement site the angulation was modified.
4. Radiographically, select the proper slot for implant placement (Figure 4), correlating clinically with the mucogingival junction and puncture the selected site with probe(Figure 5). Later remove the grid.
5. Place the implant guide in position, adjust the guide vertically (by opening the screw or by closing) and horizontally such that the point of puncture is in center of the first helix (Figure 6).
6. Now hold the mini implant in the implant driver and place the implant driver in the guide such that the shank of the implant driver is not touching the second helix. Start inserting the mini implant and keep a watch on the second helix of the guide so that the shaft is not touching the ring or is symmetrical from all the sides (Figure 7).
7. Insert the implant till the neck and then release the implant driver and remove the guide from position. Tighten the screw, if required, in case the neck is visible (Figure 7).
8. Take confirmatory radiograph to evaluate the proximity of the implant with the adjacent tooth roots (Figure 8).

The necessary torque incorporation in base arch wires to adapt the grid and guide should be judged clinically, if required.

3.1. Advantages

1. No need for customised fabrication
2. Can be used in all four quadrants including anterior segments
3. Grid and guide can be autoclaved.
4. It is very reliable and accurate method of placement of implants.

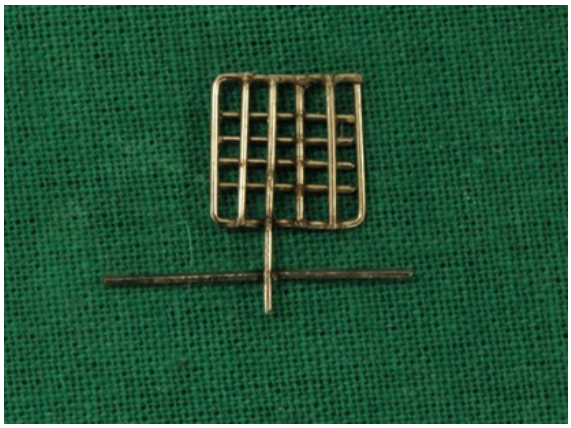

Fig. 1: Metallic Grid with horizontal base arm and vertical connecting arm

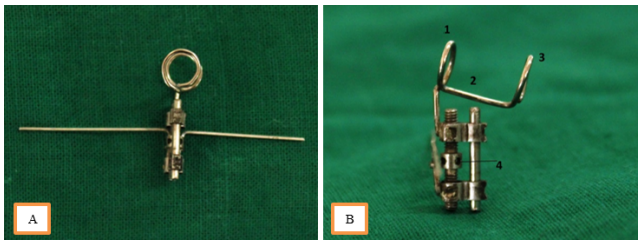

Fig. 2:

Implant placement guide (A) the transverse arm given 15^0 degree angulation for implant angulation

1. First helix
2. Transverse arm
3. Second helix
4. Driving shaft

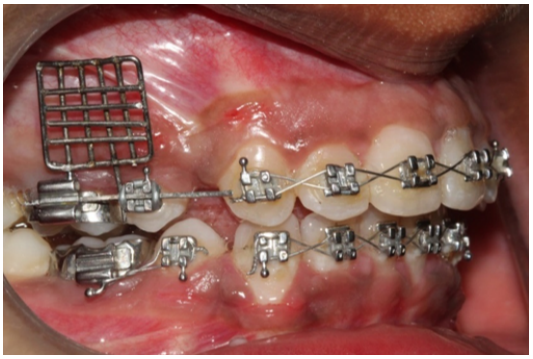

Fig. 3: Grid in place for implant site selection

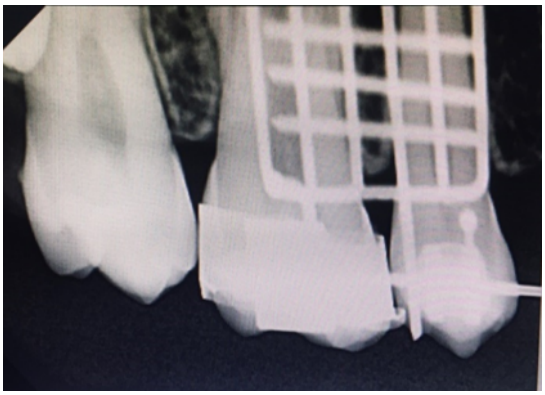

Fig. 4: Radiograph for site selection interproximally

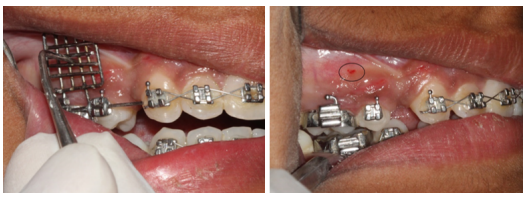

Fig. 5: Punch the selected site with probe

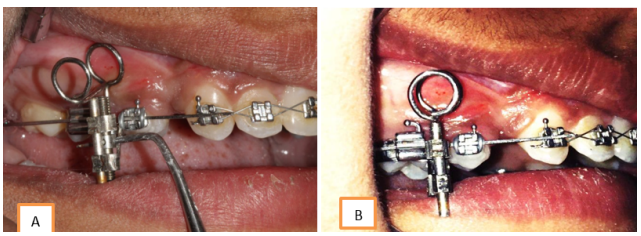

Fig. 6: Guide placed in position and adjusted vertically by closing the screw(A) the punched site in center of the helix (B)

Fig. 7: Implant placed in the center of the helix

4. Source of Funding

None.

5. Conflict of Interest

None.

Fig. 8: Implant placed with 15^0 angulation with proper interproximation between the roots.

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