

# Assessment of Orthodontist's Prospects and Acquaintance Regarding Miniscrew Implants

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## ABSTRACT

### BACKGROUND

Globally there has been an increase in the usage of miniscrew implants (MSI) because it expanded the envelope of discrepancy which led to the management of most severe cases without surgery. There is limited data available about awareness and usage of MSI among Indian orthodontists. So, the purpose of this study was to evaluate the Indian orthodontists' experiences regarding MSI.

### METHODS

The study sample consisted of 1000 qualified orthodontists practicing in India. The present study was a questionnaire-based survey, circulated among the orthodontists through Google forms. The questionnaire included both close-ended and self-administered questions. The data was analysed using the statistical analysis SPSS software version 20.0.

### RESULTS

Out of 2000 circulated Google forms there was 50 % response rate. Among the participants, 95.7 % had attended training for MSI placement. Among the participants who attended training, 81.1 % were using mini screw in practice, of whom 60 % participants had placed more than 50 implants. Most participants (70.9 %) recommended insertion torque of 5 – 10 Nm and for the time of force application, 48.6 % go with force application immediately after placement. Most participants (75.7 %) were satisfied with MSI usage.

### CONCLUSIONS

There has been an increase in the usage of MSI among the Indian orthodontists. The knowledge, awareness and experience about MSI among Indian orthodontists was in accordance with recent global trends. The failure rate experienced by Indian orthodontists was similar to orthodontists practicing globally.

### KEY WORDS

Mini Screw Implants (MSI), Orthodontists, Survey, India

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## BACKGROUND

Daskalogiannakis defined anchorage as “resistance to unwanted tooth movement”. Adequate anchorage control is fundamental for successful orthodontic treatment. Conventionally, orthodontists have used intraoral appliances and extraoral appliances to control anchorage and achieve required tooth movement. Based on Newton’s third law, anchorage units experience an equal and opposite force. Negating this reciprocal force has been and still is in focus, emphasising the need for biomechanical considerations and research in orthodontics. The evolution of temporary anchorage devices was based on the development and improvement of traditional orthodontic anchorage, dental implants and orthognathic fixation methods. Later, modifications of these techniques were unified with basic biologic and biomechanical principles of osseointegration into orthodontic mechanics that were finally improved based on experiences with interdisciplinary dentistry.<sup>1</sup>

Miniscrew implants is a bone-based anchor referred to as temporary anchorage devices (TADs). This form of anchorage has been widely accepted by the profession and has provided a facility for orthodontists to widen their clinical scope of appliance therapy.<sup>2</sup>

Recently, arising importance on the miniscrew implant type of TADs. Miniscrew implants have been used as anchorage for tooth movements that could not otherwise have been performed such as, patients with insufficient teeth for the application of conventional anchorage, cases where the forces on the reactive units would generate adverse side effects and patients with a need for asymmetrical tooth movements in all planes of space. Technical advances in miniscrew implant design have led to a decrease in discomfort and chair time during their placement and avails the increase in the envelope of discrepancy which leads to the management of most severe cases without surgery.<sup>3</sup>

The miniscrew implants are available at various design based upon the manufacturer’s specifications. The advantage of MSI was, its insertion and removal does not require any specific surgical procedure. In contrast with other means available such as orthodontic implants, miniplates and onplants, that require flap surgery, MSI can be easily inserted chair side as there is no need for any complicated clinical and laboratory procedures. In case of absolute anchorage, MSI offers a variety of locations where it can be easily applied and removed. However, this has certain drawbacks like failure during and after placement due to material used, technique sensitivity and biological factors.<sup>4</sup> Hence orthodontists have mixed opinions on the usage of temporary anchorage devices.

So, this study was done to assess the orthodontist’s prospects and acquaintance regarding MSI usage in orthodontic practices, based on a survey.

## METHODS

The study protocol was approved by the institutional review board of Sathyabama Institute of Science and Technology (IBSC). The participants participated voluntarily, and informed written consent was obtained. They were assured

that no personal information would be shared and their data would be kept confidential.

This survey was based on a questionnaire circulated among 2000 Indian orthodontists. Study period was from June 2020 to December 2020. They were asked to participate in the study by an invitation letter distributed via internet (E-mail or social media). An online questionnaire using Google forms was used to collect the data. The validity and reliability of the questionnaire was accessed. This recollection, experience and opinion-based questionnaire was divided into 3 sections:

1. Practice characteristics: which includes zone of practice, gender distribution, clinical experience and nature of practice.
2. MSI experience: which includes training attended, number of MSI placed, recommended insertion torque, time of force application, material of choice, preplacement patient anxiety assessment, preferred MSI systems, soft tissue overgrowth and recommended oral hygiene measures.
3. MSI complications: which includes cause and rate of failures and post failure management.

## Statistical Analysis

Data were analysed using SPSS software version 20.0 and depicted in terms of percentages. Blinded, annotated data were extracted for statistical analysis. Cross-tabulations were performed as appropriate and the significance of observed differences was assessed by means of chi-square test. The level of significance was set at  $P < 0.05$ .

## RESULTS

The study population comprised of 2000 eligible orthodontists throughout India and questionnaire was circulated as Google forms, out of which there was a 50 % response rate. The questionnaires were divided in to three categories as follows,

### Practice Characteristics

Among the participants, 57.3 % were from South India and 42.7 % were from North India, which comprised of 55.6 % males and 44.4 % females. Respondents’ clinical experience was categorised, and the % of participants was 54.2 % for 6 - 15 years, 34.8 % for 0 - 5 years and 10 % for 16 - 25 years and 1 % > 25 years. Nature of practice of respondents were categorised in which 50 % participants involved only in private practice, 30.2 % in both private practice and institution, 10.4 % in government institution, 8.8 % in private institutions and 0.6 % not responded.

### MSI Experience

Among the respondents 59 % have attended live hands-on course using typodont or 3D printed models, 26.9 % attended only courses with live demo, 9.8 % attended only lectures, 3.5 % did not attend any specialization course and 0.8 % did not respond. Regarding the experience of MSI usage in practice, 59.5 % of them were using MSI for more than 5 years, 16.9 % for 2 - 5 years, 4.7 % < 1 year, 18.9 % not using MSI in their

practice; among the respondents using MSI, 37.7 % have placed 50 - 100 MSI, 21.8 % placed < 50 MSI, 16.4 % placed 100 - 200 MSI, 5.2 % placed > 200 MSI and 18.9 % not responded.

On assessment of the number of MSI placed by the respondents in past one year, 72.8 % placed 1 - 20 MSI, 5.4 % placed 21 - 50 MSI and 1.9 % placed > 50 MSI, 0.8 % have not placed MSI in past 1 year and 19.1% not responded; Regarding the usage of placement guide by the respondents, 4.3 % of orthodontists always used it, 15.6 % used them mostly, whereas 34.7% of respondents used it occasionally, 25.5 % of them never used the placement guide and 19.9 % failed to respond. Regarding insertion torque during MSI placement, 70.9 % have recommended 5 – 10 Nm, 4.6 % recommended < 5 Nm, 4.0 % recommended 10 – 15 Nm, 0.4 % > 15 Nm and 20.1 % not responded.

Regarding the time of force application after placement, 48.6 % engaged force immediately after placement, 26.4 % after 3 weeks, 5.3 % after 1 month, 19.7 % have not responded; Among MSI users, 64.7 % have titanium as material of choice, 14.4 % have stainless steel as material of choice, 20.9 % have not responded; On assessment of pre-placement patient anxiety by MSI users, 39.0 % have rated mild, 24 % as moderate and 3.1 % very high. 13.5 % users stated that patient does not encounter pre-placement anxiety and 20 % have not responded; Most respondents (67 %) graded treatment outcome using MSI as satisfied, 8.7 % very satisfied, 4.4 % dissatisfied and 0.3 % very dissatisfied, 19.6 % have not responded.

Among various available MSI systems, 24.2 % of MSI users have preferred American Orthodontics, 15.1 % Ormco, 13.4 % 3M, 6.0 % other's, 5.6 % SK surgical, 5.1 % Dentos, 3.0 % Favanchor, 2.3 % of JJ, 1.4 % Bioray, 1.2 % Orthosystem, 0.9 % Leone and Dentarum, 0.6 % Biomed and 20.3 % not responded; Regarding soft tissue over growth around MSI after placement, 33.7 % have experienced < 25 % of soft tissue over growth around MSI, 32.9 % experienced 25 – 50 % of soft tissue over growth, 0.3 % experienced > 50 % of soft tissue over growth, 11.7 % not experienced any and 21.4 % have not responded; Regarding oral hygiene instructions after MSI placement, 35.4 % of the respondents have been recommending oral hygiene measures but not specified, 24.0 % recommends mouth wash, 14.8 % have not recommended any and 20.4 % not responded.

**MSI Complications**

Regarding MSI failure after placement, 32.8 % have experienced equal proportion in both jaws, 23.8 % only in maxilla, 17.9 % only in mandible and 3.9 % not experienced any failure and 21.6 % not responded; decision after MSI failure, depends on clinical situation for 38.1 % of participants, 15.8 % replace with new implant, 14.6 % drop the idea of treating with MSI, 9.3 % replace the same MSI, 22.2 % not responded; regarding MSI failure rate, 37.6 % experience a failure rate of 10 - 25 %, 28.3 % experience a failure rate of 25 - 50 %, 9.8 % experience a failure rate of < 10 %, 2.2 % experience a failure rate of > 50 % and 22.1 % not responded.

The common cause for MSI failure was loosening on the following appointment for 50.3 %, root contact for 13 %, fracture during placement for 5.6 %, bending of MSI for 4.7 % and 26.4 % not responded.

**Relationships among Response**

Experience of Orthodontists (in Years)				
Decision after MSI failure	0 - 5	6 - 15	16 - 25	> 25
Depends on the clinical situation	76 (21.8 %)***	253 (46.7 %)***	45 (45 %)***	7 (70 %)***

**Table 1. Decision after MSI Failure**

\*\*\* P-value < .001

The relation between years of experience as an orthodontist and decision after MSI failure is statistically very highly significant. From Table 1 it is evident that among the MSI users 70.0 % with > 25 years of experience, 46.7 % with 6 – 15 years of experience, 45.0 % with 16 – 25 years of experience and 21.8 % of the respondents with 0 – 5 years of experience, have taken decision based on clinical situation in MSI failures.

Experience of Orthodontists (in Years)				
Treatment outcome using MSI	0 - 5 years	6 - 15 years	16 - 25 years	> 25 years
Satisfied	157 (45.1 %)***	425 (78.4 %)***	84 (84.0 %)***	5 (50.0 %)*** very satisfied

**Table 2. Treatment Outcome Using MSI**

\*\*\* P-value < .001

The relation between years of experience as an orthodontists and satisfaction of treatment outcome is statistically very highly significant. From Table 2 it is evident that 84.0 % of the respondents were satisfied with MSI treatment outcome with 16 - 25 years of experience as orthodontist, 78.4 % of the respondents were satisfied with 6 - 15 years of experience, 50.0 % of the respondents were very satisfied with > 25 years of experience and 45.1 % of the respondents were satisfied in 0 - 5 years of experience as orthodontists.

Years of Using MSI			
Decision after MSI failure	Less than 1 year	2 - 5 years	More than 5 years
Depends on the clinical situation	13 (27.7 %)***	78 (46.2 %)***	290 (48.7 %)***

**Table 3. Decision after MSI Failure**

\*\*\* P-value < .001

The relation between years of using MSI and decision after MSI failure is statistically very highly significant. From Table 3 it is evident that 48.7 % of the respondents with > 5 years of using MSI, 46.2 % of the respondents with 2 – 5 years of using MSI and 27.7 % of the respondents with less than 1 year using MSI have taken decision based on clinical situation in MSI failures.

Years of Practicing Orthodontics				
Reason for most common MSI failure	0 - 5	6 - 15	16 - 25	> 25
Loosening on the following appointment	93 (26.7 %)***	330 (60.9 %)***	73 (73.0 %)***	7 (70.0 %)***

**Table 4. Reason for Most Common MSI Failure**

\*\*\* P-value < .001

The relation between years of practicing orthodontics and reason for MSI failure is statistically very highly significant. From Table 4 it is evident that 73.0 % of the respondents with 16 - 25 years of experience as orthodontist, 70 % of the respondents with > 25 years of experience, 60.9 % of the respondents with 6 - 15 years of experience and 26.7 % of the respondents with 0 - 5 years of experience as orthodontist have loosening of MSI on the following appointment as a reason for MSI failure.

## DISCUSSION

### Practice Characteristics

Questionnaire-based survey was circulated among the 2000 Indian orthodontists through Google forms. Among 2000 circulated Google forms about 50 % of the orthodontists have responded to the survey and informed written consent was obtained from all participants. This response was much higher compared to the response rate of 7.7 % and 6 % in a study conducted by Keim RG et al.<sup>5</sup> and Buschang PH et al.<sup>6</sup>

### MSI Experience

In our survey 95.7 % of the participants have reported that they received training for MSI placement. In a similar survey done by Hyde JD et al.<sup>7</sup> reported that 12.8 % of American orthodontists received training for MSI placement. However, this survey was completed before 2010 and it was probable that orthodontists were interested in receiving more training as the usage of MSI have become more established.

The proportion of orthodontists using mini screw in practice was 81.1 % which is comparatively higher when compared to the results (57 %) of the similar study done by Shetty S et al.<sup>8</sup> in 2019. Most of the participants (59.5 %) are using MSI for more than 5 years.

In our survey, participants who attended training for MSI placement was 95.7 % but who were implementing MSI in their practice was only 81.1 %. The reason for not using MSI in their practice after training may be due to fear of risk factors or patient refusal as supported by a survey by Ahmed Meeran et al.<sup>9</sup> concluding that Indian orthodontists did not use MSI mainly due to fear of risk factors (54 %) and patient refusal (29 %).

In a study done by Buschang et al.<sup>6</sup> in 2008 among American orthodontists, the majority (57.4 %) of participants had only placed 10 or fewer MSI, similar to Barthelemi and Beauval's<sup>10</sup> study in 2015 among French orthodontists, in which 65 % of MSI users had treated lesser than 10 patients. In the present study, there was high number of respondents who had placed more than 50 MSI (60.3 %), which makes sense as the previous studies were completed in 2008 and 2015, the trend has been towards an increase in MSI usage among the orthodontists.

Optimal positioning has always been a critical factor for the effectiveness and success of miniscrew implants. A surgical guide provides three-dimensional surgical bur control, for accurate placement of MSI, at the desired location and angle.<sup>11</sup> In our survey, 546 respondents used a surgical guide for MSI placement, which is comparatively higher to the response rate of (463) participants using surgical guide for MSI placement,

in a survey done by Ahmed Meeran et al.<sup>9</sup> among the Indian orthodontists.

Most respondents (70.9 %) recommended insertion torque of 5 - 10 Nm which is in agreement with the studies done by Motoyoshi et al.<sup>12</sup> which concludes that minimum insertion torque (MIT) in maxilla and mandible is 5 - 10 Nm for higher success rates than MIT > 10 or < 5 Nm.

Among the participants 48.6 % applied force immediately. These results were in accordance with the study done by Chen Y et al.<sup>13</sup> in 2009 and by Jambi S et al.<sup>14</sup> in 2014.

In the present survey, majority of Indian orthodontists (75.7 %) were satisfied or very satisfied with their MSI treatment outcomes. In a similar survey distributed to American orthodontists, 75.2 % of respondents were satisfied or very satisfied with their MSI success.<sup>6</sup> In a survey of French orthodontists, 74 % were satisfied with their experience with MSI.<sup>10</sup> From these results it is apparent that orthodontists are generally satisfied with MSI treatment outcome and this is probably truer in recent years as the profession has narrowed on which types of cases acquires most benefit from skeletal anchorage.

The most commonly used MSI systems in the present study were American orthodontics followed by Ormco and 3M oral care. These manufacturers may be popular because they are large companies that orthodontists might already be using their products.

In our present study soft tissue overgrowth adjacent to miniscrew insertion site was reported by 66.9 % of orthodontists which is higher when compared to the results of a survey by Ahmed Meeran et al.<sup>9</sup> The studies done by Park HS et al.<sup>15</sup> and Viwattanatipa N et al.<sup>16</sup> have found inflammation and soft tissue overgrowth to be significant risk factors associated with MSI failure.

Among the participants 64.8 % advice special oral hygiene measures such as mouth wash, brushing around implants which plays a vital role in success of MSI as supported by the studies conducted by Kuroda S et al.<sup>17</sup> Kyung SH et al.<sup>18</sup> Luzi C et al.<sup>19</sup> Park HS et al.<sup>20</sup>

### MSI Complications

Among the participants, 32.8 % of orthodontists experienced same failure rate of MSI in maxilla and mandible. This result was in agreement with the studies by Moon CH et al.<sup>21</sup> Antoszewska J et al.<sup>22</sup> Lim HJ et al.<sup>23</sup> Kim SH et al.<sup>24</sup>

Majority of the participants (37.6 %) reported with the failure rate of 10 - 25 % which was in accordance with the study done by Bayat and Bauss et al.<sup>25</sup> Bechtold et al.<sup>26</sup> Hedayati et al.<sup>27</sup> and Motoyoshi et al.<sup>12</sup> followed by 25 - 50 % of failure rate by 28.3 % of respondents as supported by the study by Sarul et al.<sup>28</sup> Herman et al.<sup>29</sup>

The clinical problem associated with MSI failure given by Indian orthodontists was loosening of the screw (50.3 %), which was similar to the results of the study done by Hyde JD et al.<sup>7</sup> among American orthodontists and a systematic review by Reynders R.<sup>30</sup> The major drawback while using miniscrews appeared to be failure due to miniscrew loosening even with the orthodontists having more clinical experience and have been placing implants for more than 5 years. The reason for MSI loosening appears to be multifactorial and is a disconcerting and unpredictable reality which we have to

embrace in our clinical practice as supported by the study done by Cheng SJ et al.<sup>31</sup>

In our survey, pain and discomfort in the insertion site have been a reason for removal of MSI in 20.6%. In a study conducted by Kuroda et al.<sup>32</sup> 35 % of patient experience pain even after one week when placed by flap method.

### CONCLUSIONS

There has been an increase in the usage of MSI among the Indian orthodontists, which clearly indicates increased awareness of MSI. The knowledge and experience about the MSI among the Indian orthodontists in insertion torque, force application and oral hygiene measures were in accordance with recent global trends. Most orthodontists prefer American orthodontics followed by Ormco and 3M oral care titanium MSI. Failure rate experienced by Indian orthodontists was similar to orthodontists practicing globally and the main reason for MSI failure may be due to soft tissue overgrowth. As experience increases, the decision is made on clinical situation when there was an MSI failure and the degree of satisfaction with MSI post treatment outcome increased to 'very satisfied'.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.

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