ORIGINAL RESEARCH ARTICLE

AUTOTRANSPLANTATION OF MOLARS: A PROSPECTIVE CLINICAL & RADIOGRAPHIC STUDY

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ABSTRACT

Purpose: To assess the efficacy of autotransplantation of molars and the viability of the procedure to replace un-restorable molar tooth by studying the various parameters of gingival condition, tooth mobility, pulp vitality, ankylosis, and periodontal condition of transplanted tooth and to follow up the transplanted tooth radiographically at interval of 1, 3 and 6 months and to observe the condition of roots for resorption, root ankylosis, periapical healing and alveolar bone height.

Methods: A total of 50 healthy patients aged between 16 to 38 years with impacted third molars and non-restorable first or second molars were randomly selected for the study. All the donor teeth were transplanted within 3-16 minutes of extra oral time and the procedure was completed with average surgical time of 60 minutes. All the transplants were assessed clinically and radiographically at 1 month, 3 month, and 6 month.

Results: All results were calculated using the mean value and standard deviation for each of the parameters considered and checked for statistical significance using Wilcoxon test. Out of 50 transplants, five transplants despite of good initial stability, was extracted after one month because abnormal horizontal and axial mobility, that was the five failure case(10%), rest 45/50 (90%)transplants were followed up for 6 months.

Conclusions: Transplantation of a third molar in a selected patients for replacement of a lost or seriously damaged molar tooth could be a reasonable alternative to conventional prosthetic rehabilitation or an implant treatment.

Key Words: Autotransplantation, Molar, Gingival Condition, Tooth Mobility, Ankylosis, Periodontal Condition

INTRODUCTION

A significant number of patients have premature loss of their first and second molars because of dental caries, periodontal disease, root fractures, complications after root canal therapy etc. Often these patients are not the candidates for replacement of these edentulous areas with titanium dental implants because of their age or simply for financial reasons. Autotransplantation is a viable option for replacing a missing tooth when a donor tooth is available. [1] Autotransplantation

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refers to the repositioning of autogenous teeth in another tooth extraction site or surgically formed recipient site to replace teeth. Autogenous tooth transplantation was first well documented in 1956 by M.L. Hale.[2] The two most common transplantations are of impacted canines, when orthodontic treatment is not feasible and of impacted third molar to substitute for first or second molars. Successful autotransplantation results in maintenance and regeneration of alveolar bone, maintenance of attached gingiva with a natural shape, esthetic results are better, low cost, single stage surgery, orthodontic movement is possible and preservation of proprioception. Thus autotransplantation offers one of the most economical and fastest means of replacing missing teeth.

The present study was undertaken to assess criteria for success or failure of the autotransplanted tooth by studying the various parameters of gingival condition, tooth mobility, pulp vitality, ankylosis, and periodontal condition of transplanted tooth and to follow up the transplanted tooth radiographically at interval of 1, 3 and 6 months to observe the condition of roots for resorption, root ankylosis, periapical healing and alveolar bone height.

MATERIALS AND METHODS

A total of 50 healthy patients; both male and female aged between 16 to 38 years, who had impacted third molars and non-restorable first or second molars, were randomly selected for this study.

Inclusion Criteria

- Participants between ages of 16-38 years of both sexes.
- Without systemic disorders or previous history of complications associated with local anesthetics.
- Non infected caries free retrievable impacted mandibular or maxillary 3rd molars.
- Preferably root development of 3rd molar is between one-third and three-fourths complete.
- Non restorable mandibular or maxillary first or second molar with favorable bone height and healthy gingival condition.

Exclusion Criteria:

- Acutely infected donor or recipient site,
- Patients who are prone to dental caries & those with poor oral hygiene.
- Patients with systemic diseases contraindicative to surgery.
- Patients with inability to follow postoperative instructions.
- Unwillingness or inability to be followed up for radiographic and clinical examination.

All patients voluntarily gave consent and signed an informed consent form before participating in the study.

Surgical procedure:

The preoperative evaluation included the blood investigations and the radiological assessment which was done using Orthopantomograph (OPG) and an intraoral periapical radiograph (IOPA) so as to assess the condition of roots and

position of the third molar as well as alveolar bone height of the first or second molar.

All patients were treated on an ambulatory basis at department of Oral & Maxillofacial Surgery with prophylactic antibiotic coverage with 500 mg amoxicillin oral 1 hr. prior to procedure and the same antibiotic coverage continued for 5 days TDS dose with an analgesic.

Under all aseptic precautions local anesthesia 2% lidocaine with epinephrine, 1:80,000 was given and the carious first or second molar were extracted atraumatically to prevent any tear of the surrounding gingival cuff. The sockets of first or second molar were prepared by removing the inter-radicular bone and apical bone (Fig 1- Fig.5).

A standard modified Ward's incision was given and full thickness mucoperiosteal flap was reflected for the exposure of the donor tooth (impacted third molars).

The distal and buccal bone guttering was done if required taking care to prevent any damage to the crown and root of the donor tooth preserving the root sheath and apical portion of the developing root.

The donor tooth was placed in the recipient socket in such a way that it is placed 2-3 mm below the occlusal level so as to avoid premature occlusal contacts.

Buccal and lingual gingiva around the transplanted tooth was approximated tightly with 3-0 silk sutures to provide a water tight gingival cuff around the transplant and if the initial mobility was not satisfactory it was splinted with a 26 gauge wire in a figure of "8". A COE pack was applied buccally and lingually to prevent ingress of oral fluids (Fig 6- Fig. 10)

All the patients were given routine post-operative instructions and were followed up after 24 hours.

The clinical assessment was done by recording the gingival condition of the implant, mobility of the transplanted teeth, periodontal pocket depth, pulp vitality and clinical ankylosis.

The radiographic assessment was done by scoring for root resorption, periapical bone, ankylosis and inter-alveolar bone height (Fig. 11).

RESULTS

Results were evaluated based on clinical observation and radiographic analysis of the transplanted tooth.

All results were calculated using the mean value and standard deviation for each of the parameters considered and checked for statistical significance using Wilcoxon test.

The viability of the transplanted tooth was assessed by studying the various parameters of gingival condition, tooth mobility, pulp vitality, ankylosis, and periodontal condition of transplanted tooth (Table 1 – 2).

In brief, five transplants despite of good initial stability were extracted after one month due to abnormal horizontal and axial mobility while the rest forty five transplants were stable for follow up period of 6 months. Forty three transplants (95.5%) showed excellent periodontal healing & showed normal pocket depth at the end of sixth month. Seven transplant teeth (15.56%) showed positive pulp

response by the end of sixth month. The others were recommended for root canal treatment. Forty-four transplants (97.78%) showed no clinical sign of ankylosis at the end of sixth month.

Thirty transplants (72%) had normal interdental bone height seen radiographically at the end of sixth month. Only two transplants (4.44%) root formation ceased and it was ankylosed to the bone, clinically it showed metallic percussion tone but it was normal in function. Only six transplants (12%) with complete root formation showed surface resorption while rest teeth (78%) showed no resorption at all.

DISCUSSION

The replacement of missing, extracted or grossly carious permanent teeth has always been a challenge for dentists. Despite the widespread use of dental implants, autogenous tooth transplantation is frequently performed to replace missing mature teeth.[3] Autotransplantation refers to the repositioning of autogenous erupted, semi-erupted or unerupted tooth, from one site into another in the same individual.

The general indications of autotransplantation are transplantation of impacted teeth to their normal position (trans-alveolar transplantation), agenesis of teeth (congenitally missing and lost teeth) and those cases of avulsion where the prognosis for successful reimplantation is poor, replant failure and untreatable root fractures. Successful transplantation has also been reported in surgically prepared sockets as well in a free vascularized fibula reconstructed mandible. Autotransplantation has also been used for immediate closure of oroantral communication after tooth extraction with good results.

The literature reports excellent success rates following tooth transplantation when the appropriate protocol is followed. Andreasen [4] found 95% and 98% long-term survival rates for incomplete and complete root formation of 370 transplanted premolars observed over 13 years[2]. Lundberg and Isaksson[5] had success in 94% and 84% of cases for open and closed apices respectively in 278 autotransplanted teeth over 5 years.

In our study the modified Chamberlin and Goerig's[6] criteria's of success for tooth transplantation was followed. Our study showed 90% success rate at the end of six months. Forty five out of fifty transplants were successful; only five mandibular transplants were extracted after the follow up of 1, 3 & 6 month due to abnormal horizontal and axial mobility. This was attributed to fact that the roots of transplant were short and conical. And there was lack of distal alveolar bone height at the recipient site.

The initial stability affects the prognosis, because sufficient initial stability can avoid dislocation of the autotransplanted teeth. Fixation with splint and sutures has been used to stabilize the autotransplanted teeth. Prolonged rigid fixation of autotransplanted immature third molars has a significantly negative influence on final root length and root length increment, especially in transplants at earlier developmental stages.[7] In our study, good initial stability was achieved with good root to bone contact in 45 (90%) of the cases, only in one case of maxillary molar transplant because of its conical roots, the initial stability was not satisfactory. It was

splinted with the adjacent tooth in a figure of '8' splinting with 26 gauge wire and was kept for 2 weeks. Tight closure of the gingival flap around the transplants was done and it was covered with COE pack for 1 week to prevent ingress of oral fluids and microorganisms and a tight cuff of gingiva may have provided good periodontal reattachment. Also the transplants were secured 1-2mm in infra-occlusion to prevent trauma from occlusion during periodontal healing. As a further precaution the patients were asked not to chew on that side for 2 weeks.

The extra oral time of the donor tooth is again a very important factor with regard to the prognosis of tooth transplantation. Studies have showed that the viability of periodontal ligament exposed to the extra oral space decreased rapidly after 18 minutes.[8] In our series, in all the cases, transplantation was performed within 3 to 16 minutes.

Preservation of Hertwig's epithelial root sheath / periodontal ligaments is another key factor for successful autotransplantation.[9] In our study, the periodontal ligaments were preserved by the atraumatic extraction of donor tooth and the transplants were held with the crown and touching of root surface was avoided. Also the donor tooth was luxated but still left in the socket to provide a favorable environment to the transplant.

Ankylosis strongly correlates with damage to the root surface during the operation. In our study, ankylosis was seen in one case of maxillary transplant with incomplete root formation. Root formation was ceased and bone was formed around the root, but the transplant was normal in function and showed no periapical radiolucency and the gingival condition and pocket depth were normal.

Pulpal response to electric pulp testing (EPT) indicates the presence of nerve fibers carrying sensory impulses; they do not provide any information about the vascular supply, which is the real determinant of pulp vitality.

In the present study, out of 45 EPT-negative transplants, 31 showed no periapical radiolucency while 14 transplants showed persistent radiolucency around the periapex at the end of three months, so only these 14 transplants were treated endodontically and they showed resolution of the periapical radiolucency at the end of six months and the remaining 31 showed no sign of deterioration after six months.

Tooth transplantation offers several benefits compared with other methods, such as implant. First, most tooth transplantation procedures can be accomplished in a single surgery. Secondly, the transplanted tooth restores its proprioceptive function and normal periodontal healing. Furthermore, the transplanted tooth can serve as a bridge abutment or as an orthodontic anchorage. Tooth transplantation in growing children can offer another benefit of continued alveolar bone induction.

However, tooth transplantation is not recommended for patients with a multi edentulous area, those who are prone to dental caries, with poor oral hygiene, and those with systemic diseases. A major problem of autotransplantation is that it requires an appropriate donor tooth with good root volume and length, easy for extraction, and the one which is not

periodontally involved. Surgical difficulties may be another problem in tooth transplantation.

CONCLUSION

The present study attempted to assess the efficacy of autotransplantation of molars and the viability of the procedure to replace unrestorable molar teeth. Our study supports the hypothesis that transplantation of a third molar for replacement of a lost or seriously damaged molar tooth could be a reasonable alternative to conventional prosthetic rehabilitation or implant treatment in carefully selected patients. However long term follow up is required for assessment of the viability of the autotransplantation.

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TABLES

Clinical Parameter		N	Mean	Std. Deviation	Wilcoxon Test	Inference
Gingival Condition	(1 month)	50	12.50	12.23	p = 0.000	Significant
	(3 month)	46	11.50	14.47		
	(6 month)	45	11.50	20.52		
Transplant Mobility	(1 month)	47	0.510638	0.718463	p =0.003	Significant
	(6 month)	45	0.00	0.00		

		1 Month		3 Month		6 Month	
		n	**%**	**n**	**%**	**n**	**%**
Periodontal Pocket Depth	Physiologic pocket depth (0-3mm)	7	14.0%	27	58.70%	43	95.5%
	Pathologic pocket depth (>3 mm)	43	86.0%	19	41.0%	2	4.5%
PulpVitality	Non Sensitive	41	82.0%	39	84.78%	38	84.44%
	Sensitive	9	18.0%	7	15.22%	7	15.56%
Clinical Ankylosis	No ankylosis present based on physiologic percussion tone	50	100%	46	92.0%	44	97.78%
	Ankylosis present based on metallic percussion tone	0	0.0%	0	0.0%	1	2.22%

Table 1: Statistic Results of Clinical Parameter

Radiographic Parameter		N	Mean	Std. Deviation	Wilcoxon Test	Inference
Inter dental alveolar bone height	(1 month)	50	0.36	0.53	p = 0.317	Not significant
	(6 months)	45	0.24	0.53		

		1 month		3 months		6 months	
		n	**%**	**n**	**%**	**n**	**%**
Periapical bone	No abnormality detected around the periapex of the transplant	28	56.0%	33	71.74%	42	93.33%
	Pathologic changes such as diffuse periapical radiolucency present	22	44.0%	13	28.26%	3	6.67%
Radiographic ankylosis	No ankylosis present based on presence of lamina dura and periodontal space around the	50	100.0%	46	92.0%	43	95.56%
	Ankylosis present based on absence of lamina dura and periodontal space	0	0.0%	0	0.0%	2	4.44%
Root Resorption	Normal healing	50	100%	45	90.0%	39	78.0%
	Surface resorption	0	0.0%	1	2.0%	5	10.0%
	Inflammatory resorption	0	0.0%	0	0.0%	1	2.0%
	External resorption	0	0.0%	0	0.0%	0	0.0%
	Internal resorption	0	0.0%	0	0.0%	0	0.0%

Table 2: Statistic Results of Radiographic Parameter

FIGURES:

Fig. 1: Preoperative view of carious 46

Fig. 2: Preoperative view of 48

Fig.3: Extraction of 48

Fig.4: Preoperative IOPAR of 46

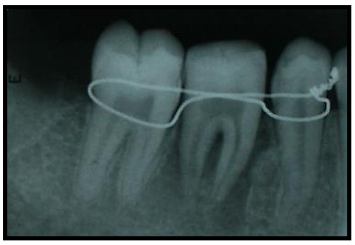

Fig.5: Immediate IOPAR of transplanted tooth

Fig.6: Immediate transplant of 48 in the socket of 46

Fig.7: Transplant secured with 3-0 **BB** silk suture

Fig.8: Transplant splinted with 26 gauge **SS** wire

Fig 9: COE pack applied

Fig.10: 1-2 mm occlusal clearance of the transplanted tooth

Fig.11: Six month postoperative IOPAR