

A comparison of autotransplantation and orthodontics in a case exhibiting two ectopic upper cuspids

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Bilateral severely ectopic maxillary cuspids were treated differently on each side. On one side the ectopic cuspid was moved into position orthodontically, and on the other, the ectopic cuspid was positioned by autotransplantation. The orthodontic positioning took a long time and the tooth exhibited root resorption. Treatment time for the autotransplantation positioning was far quicker, and there was no resorption nor were there any other side effects.
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Introduction

There are various methods available for the treatment of severely ectopic teeth; namely, orthodontic forces alone, autotransplantation of the ectopic tooth to its correct position, and extraction and replacement with an implant. There are advantages and disadvantages with each method, and the best approach depends on the specifics of each case.

Orthodontic treatment alone is conservative but can be slow. Exposure of the ectopic tooth can be difficult. Severe anchorage requirements can distort the archform if carefully controlled mechanics are not used, and other orthodontic problems may make for very long treatment times, with consequent increase in the risk of root resorption.

Implants can successfully replace missing teeth. However, they cannot be used in growing subjects, and the long-term effects of single-tooth implants on the human skeleton throughout adult life are not known. The high cost of implants must also be considered.

Autotransplantation of the ectopic tooth to its correct position can be effective in reducing treatment time, but there are risks of non-completion of root formation, resorption and/or ankylosis, and pulp necrosis. Some reports from the 1950s, 60s and 70s of relatively low success rates for the autotransplantation procedure have perhaps reduced its popularity. However, more recent studies outlining more careful attention to case selection and technique show success rates at the 90-plus per cent level.

Completion of root formation following transplantation of a tooth with an incompletely formed root is not a certainty. Hertwig's epithelial root sheath can survive intact on the transplanted root and continue to form new root structure. It may also be left at the donor site where it may form a root apex. Delaying transplantation until the root is two-thirds to three-quarters formed ensures that there will be adequate root length, even if no more root development occurs.

Ankylosis will result from damage to the periodontal ligament on the tooth root surface during the transplant procedure. The damage can be caused mechanically during extraction at the donor site or insertion at an incompletely prepared recipient site, by drying of the root, or by the use of non-physiological chemicals on the root surface. The surgical technique employed should produce the least possible damage to the periodontal ligament on the tooth surface. For extraction, alveolar bone should be dissected away as necessary. Teeth with conical roots are better candidates for transplantation because of the ease of extraction. Donor site preparation should be sufficient to allow placement of the transplant without impinging on alveolar bone or the opposing teeth in occlusion.

Inflammatory resorption causing resorption of tooth root and adjacent alveolar bone can be associated with necrotic and infected pulpal tissue following transplantation. Monitoring of the transplanted tooth and provision of endodontic treatment when necessary will control inflammatory resorption.

Teeth transplanted with incomplete apices will usually exhibit revascularisation of the root canal followed by calcification. Endodontic treatment is therefore not needed in most cases. Teeth transplanted with complete root apices cannot be revascularised and therefore need routine endodontic treatment soon after transplantation.

The purpose of this article is to present the possibilities of autotransplantation of teeth as an alternative to conventional orthodontic treatment. By demonstrating both approaches in one case, a better understanding of case selection is obtained.

Medical and dental history

A 10 year-old male was referred by his general dentist with a complaint of multiple missing permanent teeth and ectopically-developing teeth.

The medical history was non-contributory. Dental treatment had been minimal.

Clinical and radiographic examination

The patient's face was tending to be long, with a flat mid-face and straight profile. The lips were together at rest. Cephalometric analysis showed the maxilla retrusive and the mandible long, vertically and horizontally. The upper incisors were normal in the maxilla, and the lowers were retroclined in the mandible. Overbite, overjet, and molar relation were normal.

Specific problems

Missing: 8 teeth (12, 15, 22, 45, 18, 28, 38, 48).

Ectopically developing, transposed: 4 teeth (13, 14, 23, 24).

Ankylosed: 6 deciduous teeth (54, 55, 74, 75, 84, 85).

Skeletal Angle Class III mid-face deficiency; open bite tendency with dental compensation.

Diagnosis and treatment plan

This was a case of multiple missing teeth, transposition of permanent teeth and ankylosis of deciduous teeth with a dentally compensated, Class III dolicho-facial skeletal pattern.

The immediate problem was to try to improve the transposition. It was considered important to correct the position of the cuspids in this case for two reasons. One was that the Class III skeletal relationship meant that there was a relative lack of fullness in the mid-facial region, which would be made more severe by distally placed cuspids. The second reason was that having missing lateral incisors would complicate the obtaining of adequate space closure and anterior aesthetics with bicuspid in the cuspid position.

Extraction of all four upper deciduous molars was performed. Once permanent teeth had erupted, the plan was to use orthodontic treatment to open normal pontic spaces for the missing teeth.

The patient did not return for routine recalls for two and a half years after the extractions. When he returned, all upper permanent teeth were erupted, with significant transposition of the cuspids and first bicuspid in the upper arch. The treatment plan was devised to transplant the upper left cuspid to its correct position in the arch, and to extract the deciduous lateral incisor and cuspid to make room for the permanent cuspid. Orthodontic treatment was to be used to correct the transposition on the right side, which was not as complete as on the left. Because of the missing upper right second bicuspid, there was more space for tooth movement on that side.

In the lower arch, the plan was to wait until a significant amount of correction had been achieved in the upper arch before instituting any lower arch treatment. To align and co-ordinate the arches, extraction of the ankylosed lower right second deciduous molar in the lower arch, and fixed appliances were required.

Progress of treatment

March 1987: 54, 55, 64, 65 extracted.

October 1990: Upper fixed appliances, followed by extraction of 62 and 63, and transplantation of 23 into its correct position.

November 1990: Transplanted 23 bonded with bracket and tied to archwire for stability.

December 1990: Mechanics commenced in upper right quadrant to orthodontically correct transposition by protraction of 13 and retraction of 14.

August 1991: Records reviewing progress show 14 tipping severely and roots still transposed. Transplant healthy, with no

Table 1. Cephalometric measurements.

NAME: B.J.	INITIAL RADIOGRAPH: 12/7/90					
BIRTH: 1/9/77	FINAL RADIOGRAPH: 15/2/94					
SEX: Male	INITIAL AGE: 12yr 10m					
NORM: Caucasian	FINAL AGE: 16yr 5m					
Analysis	ABO	Initial	Norm	Clinical	Dev.	Final
CRANIAL BASE						
Cranial Defl: BaN-FH	(dg)	31.3	27.3	1.3	*	29.2
Saddle Angle: NaSAr	(dg)	123.4	123.0	0.1		126.1
MAX TO CRANIAL BASE						
SNA	(dg)	75.2	82.0	-2.3	**	73.9
N Perpendicular- A	(mm)	2.5	-1.9	-0.2		-7.5
MAND TO CRANIAL BASE						
SNB	(dg)	76.4	80.0	-1.2	*	74.7
Po - N Perpendicular	(mm)	2.2	-7.2	2.2	**	-5.0
MX/MD RELATIONS						
ANB	(dg)	-1.2	2.0	-1.6	*	-0.8
Wits Appraisal	(mm)	-11.3	1.1	-6.5	***	-10.3
SIZE/Form OF MX/MD						
Max Depth: NA-FH	(dg)	87.8	90.0	-0.7		84.0
Mx Ht: CF-N to CF-A	(dg)	59.1	54.7	1.5	*	64.0
SN-Palatal Plane	(dg)	6.6	1.9	1.3	*	5.6
Md Body Length: Go-M	(mm)	81.2	70.8	2.1	**	88.4
Upr Gon A: GoAr-GoN	(dg)	48.4	53.5	-1.7	*	46.2
Low Gon A: GoN-GoM	(dg)	76.2	72.5	1.2	*	75.5
VERTICAL HEIGHT						
Facial Axis: PtGn-BaN	(dg)	89.3	90.0	-0.2		86.6
Md Plane: FH-GoM	(dg)	23.7	24.6	-0.2		26.5
MX/MD INCISOR						
Mx 1 - NA	(mm)	4.4	4.0	0.1		7.8
Mx 1 - NA Angle	(dg)	20.9	22.0	-0.2		37.5
Md 1 - NB	(mm)	1.9	4.0	-0.7		3.2
Md 1 - NB Angle	(dg)	17.5	25.0	-1.3	*	18.3
Md 1 to APO	(mm)	-0.2	1.0	-0.5		0.3
SOFT TISSUE						
Lower Lip-E Plane	(mm)	-4.7	-2.0	-1.3	*	-5.5

endodontic treatment. Elastic chain traction to 14 discontinued and TMA spring instituted for uprighting.

November 1991: Radiograph shows good uprighting of 14 but roots still transposed. Mucous extravasation cyst diagnosed on lower left labial mucosa. Referred for removal under local anaesthesia.

May 1992: Upper right transposition starting to improve but radiograph shows roots still crossed.

November 1992: Retraction of 23 commenced.

March 1993: Lower fixed appliances placed. Continuation of opening space for 22 and correction of upper right transposition.

May 1993: Extraction of 85.

January–December 1994: Consultation with prosthodontist regarding ideal tooth placement.

January–October 1995: Continuing fixed appliances to correct spacing and root angulation and co-ordinate the arches.

November 1995: Fixed appliances removed. Positioner placed due to lack of contact between 13 and 43. Slight excess overjet and openbite.

December 1995: Final records and placement of upper and lower removable retainers.

May 1996: Retainers prescribed for 12 hours per day each; the upper during the day and the lower at night. Broken retainer repaired.

June 1996: Referral to prosthodontist for more permanent restoration.

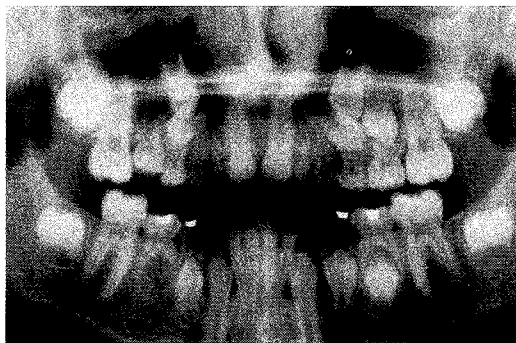


Figure 1a. Initial presentation, 3 years before treatment started.

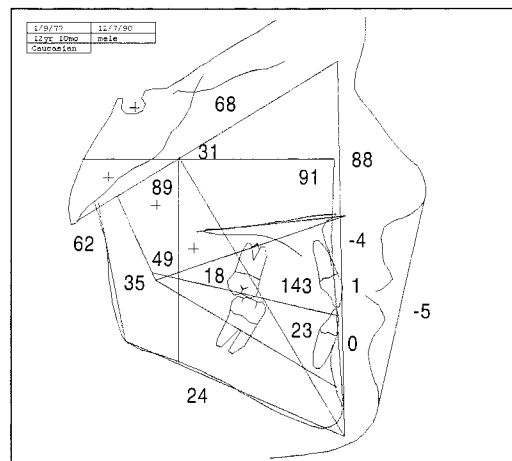
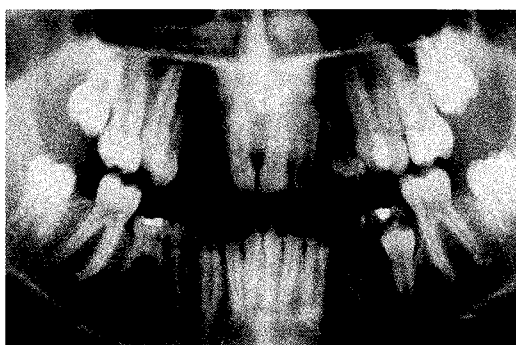


Figure 1b. Initial tracing.



Figures 2a, b and c. Start of active treatment.

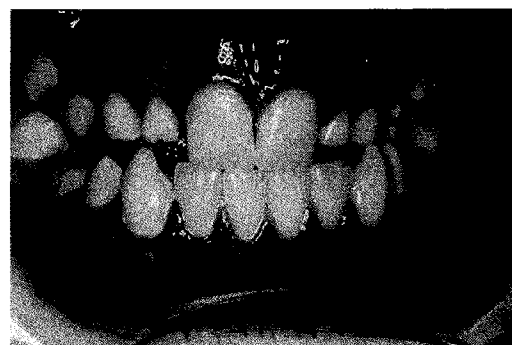
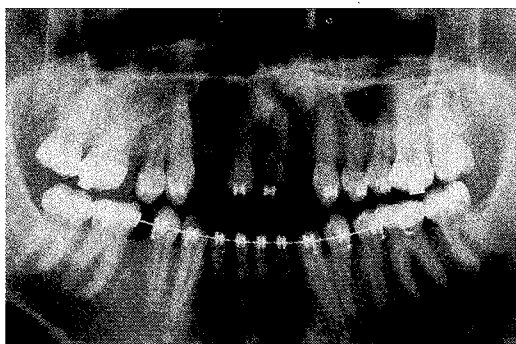


Figure 2b.



Figures 3a, b and c. Radiograph taken shortly before end of active treatment, showing root resorption of tooth 14 and non-resorbed root of 23 with calcified canal.

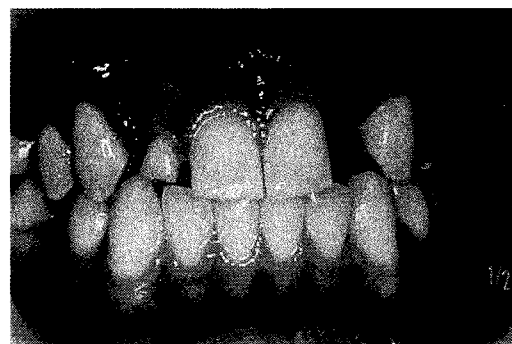


Figure 3b.

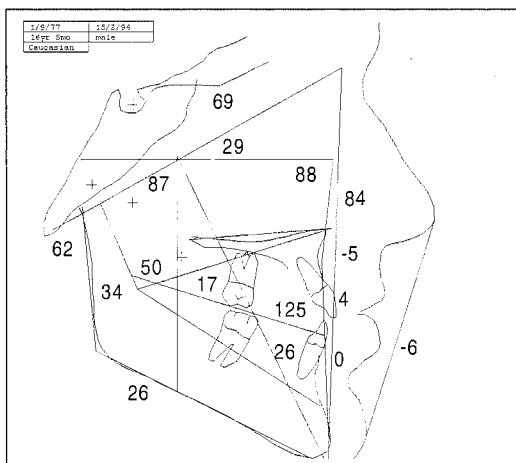


Figure 4. Final tracing.

Results

The transpositions were finally corrected and normal cuspid occlusion was achieved. Normal overbite and overjet were also maintained despite the dolicho-facial Class III growth tendency. Spaces were left for implants for the upper lateral incisors and for cantilever Maryland bridges for the upper and lower right second bicuspid.

The final and permanent restorative treatment will not be performed until the patient has finished playing competitive football. In the meantime, he will continue with some form of removable prosthesis.



Figure 2c.



Figure 3c.

Discussion

There are various points for discussion emerging from this case. One is whether closer supervision in the early years (when the patient did not return for two and a half years following the deciduous molar extractions) could have prevented the severity of the transposition. It seems unlikely that much could have been achieved because of the very mesial position of the roots of the first bicuspid. It also seems unlikely that the additional extraction of deciduous cuspids would have made much difference.

The principal point that this case illustrates is the difference between handling the transposition by autotransplantation on the left side and orthodontic

treatment alone on the right. The reason for not doing a transplant on both sides was probably related to nervousness about the prognosis for transplantation of cuspids whose roots were almost fully formed. The recommendation is that the roots should be about two-thirds to three-quarters formed for maximum success.

In this case, the transplanted side was far easier to treat. To date, the transplanted tooth appears to be perfectly healthy, despite the fact that it has exhibited calcification of the pulp chamber. There have been no symptoms, and there is no sign of periapical pathology. The tooth responded normally to orthodontic forces. The reason this case was in active treatment for five years is that on the non-transplant side it proved to be extremely difficult and time consuming to get the roots upright and into position. The orthodontic treatment on the transplant side was simple in comparison.

Orthodontically closing all spaces resulting from missing teeth was not possible due to the slow rate of tooth movement, the need to maintain anterior symmetry and the fact that the upper arch could not be constricted because of the retrusive maxilla. An anterior crossbite would have been produced by any attempt to close upper anterior spaces.

The dolicho-facial skeletal pattern meant that there was a tendency to an anterior openbite at the conclusion. Facial growth throughout treatment did show excessive vertical and horizontal mandibular growth, but there was continuing incisor compensation. The use of a positioner was beneficial in this case to improve the final occlusion.

Another point demonstrated by this case is the need for an interdisciplinary approach. A surgeon had to be consulted for the extraction of deciduous ankylosed teeth, the transplantation and the elimination of the lip mucocoele; and a prosthodontist was consulted well before appliances were removed to help in planning the pontic spaces. In the future there will need to be implant preparation.

It is recommended for cases requiring autotransplantation that a surgeon and periodontist be consulted as necessary in advance, and that an endodontist follow the post-transplant progress to see if root filling is required.

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