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Anomalies

Hypodontia

Impacted Upper Canines

Supernumeraries

Unerupted Permanent Incisor

Transpositions

Double Teeth

Primary Failure of Eruption

Ectopic Eruption of Permanent First Molars

Molar-Incisor Hypomineralisation (MIH)

Infraocclusion of Primary Teeth

Hypodontia

Definition	<ul style="list-style-type: none"> • the developmental absence of one or more teeth, excluding 8s • classed in relation to number of absent teeth: mild ≤ 2, moderate $>2 - \leq 6$, severe >6 	Goodman et al., 1994
Prevalence and Incidence	<ul style="list-style-type: none"> • incidence 6.4% population (excluding 8s); mild 81.6%, moderate 14.3%, severe 3.1% • varies in different areas of world: Africa (13.4%) > Europe (7%) > Asia (6.3%) > North America (5%) > Caribbean/Latin America (4.4%) • 5.3 - 5.6% UK population • ↑ in females • similar in max and mand 	Hobkirk et al., 1995 Khalaf et al., 2014 Khalaf et al., 2014 Polder et al., 2004 Polder et al., 2004
General features	<ul style="list-style-type: none"> • associated with microdontia and ectopic canines • associated with syndromes: Down's, ectodermal dysplasia, CLP, hemifacial microsomia • most affected permanent teeth: <ul style="list-style-type: none"> - 25-35% of all third molars - 3% of all 5s - 2% $\underline{2}$s - < 1% mandibular incisors • left > right • gene involved - MSX1 (incisor, premolar), PAX9 (molar) and AXIN2 • demonstrated to have adverse impact on quality of life measures 	Graber, 1978; Peck et al., 1996 Wisth et al., 1974 Cobourne, 2007 Wong et al., 2006; Akham et al., 2011, 2013 Gill & Barker, 2015
Presentation	<ul style="list-style-type: none"> • delayed/asymmetric eruption of permanent teeth • retained or infraoccluded primary teeth • absent primary tooth • conical/reduced crown morphology of permanent teeth present 	
General treatment principles	<ul style="list-style-type: none"> • combined planning, orthodontics/restorative opinions necessary <p>Options:</p> <ul style="list-style-type: none"> • reopen space • close space • redistribute space <p>Decision:</p> <ul style="list-style-type: none"> • maintain space for prosthesis or close space? • factors to consider: <ol style="list-style-type: none"> i. malocclusion and extent of hypodontia ii. dental features - size, shape, colour of teeth, smile line iii. pt's opinion iv. pt's co-operation 	Stevenson et al., 2013; Gill & Barker, 2015 Hobkirk et al., 1995 Grahnén, 1956
Complications /difficulties with treatment	<ul style="list-style-type: none"> • anchorage • 'necking'/atrophy of bone • root parallelism for implants • aesthetics • risk of relapse e.g. spaces reopening • long treatment time • cost 	
Absent maxillary lateral incisor	<ul style="list-style-type: none"> • 2% population • familial tendency for both peg and missing laterals • anomalous (microdont) laterals are associated with palatally ectopic canines 	Zilberman et al., 1990 Brin et al., 1986

Absent premolars	<ul style="list-style-type: none"> • premolars can form as late as 9yrs • lower 5s most commonly absent (2.6%), followed by upper 5s then 4s 	Wisth et al., 1974
Absent lower incisor	<ul style="list-style-type: none"> • more common in Asian populations 	
Treatment options	<p>Absent 2 2</p> <ul style="list-style-type: none"> • consider Xtn <u>C/C</u> to encourage <u>3/3</u> to erupt into 2 position <p>Absent 5's</p> <ul style="list-style-type: none"> • depends on crowding <ul style="list-style-type: none"> - spaced/aligned arch: preserve E - crowding: Xtn of E's when appropriate • for maximum spontaneous space closure Xtn E's at 9yrs • if E's survive until 20yrs then they appear to have a good prognosis for long term survival 	Bjerklin & Bennett, 2000 Lindqvist, 1980 Bjerklin & Bennett, 2000
Aspects of treatment	<ul style="list-style-type: none"> • preferred option - space closure if aesthetics will be good (no restorative burden) • interceptive primary Xtns for maximum spontaneous space closure • no significant difference (periodontal status, occlusion, aesthetics) between opening or closing spaces except slightly ↓ papilla fill with implant supported prosthesis • when bilateral 2s missing slightly ↑ attractiveness rating for space closure than prosthetic replacement • decision to open/close space depends on age, crowding, severity of hypodontia, attitude of family • long term periodontal studies suggest that space closure is preferable to space opening • 3 3 replacing 2 2 may require occlusal adjustments to avoid interferences (note this view precedes the now popular use of acid-etch bridges) • recontouring 3 crowns has been advocated • space maintenance and redistribution of space to accept a prosthesis may be preferred because of poor aesthetics related to unsuitable colour, position or anatomy of adjacent teeth • determine space required by golden proportion, contra lateral-tooth size or Bolton analysis • resin bonded bridges are a good option, survival of >80% over 6yrs, survival of cantilevered RBB at least as good as fixed-fixed design • consider preserving alveolar bone by retaining the primary teeth for future placement of implants (once growth has ceased) • use reverse pull HG if necessary to close spaces • use of TADs has ↑ treatment options in these cases 	McNeil & Joondelph, 1973 Lindqvist, 1980 Silveira et al., 2016 Qadri et al., 2016 Robertsson & Mohlin, 2000; Rosa et al., 2016 Nordquist & McNeil, 1975 Thordarson et al., 1991 Asher & Lewis, 1986 Bolton, 1958; Spear, 1997 Creugers et al., 1992; Hussey & Linden, 1996; Probster et al., 1997 Thilander et al., 1994 Thilander et al., 2001 Goodman et al., 1994 Mizrahi & Mizrahi, 2007; Yanosky & Holmes, 2008 Asher & Lewis, 1986 Goodman et al., 1994
Advantages - space opening	<ul style="list-style-type: none"> • combine treatment planning with trial wax set ups • prolonged retention for all cases • space closure may be slower than normal • may not be possible to close the space completely • advantageous both functionally and occlusally, favouring good intercuspation in the buccal segments • improved aesthetics 	Carter et al., 2003 Balshi, 1993
Disadvantage - space opening	<ul style="list-style-type: none"> • commits the pt to a permanent prosthesis 	Carter et al., 2003

Treatment mechanics (missing 2)

Space opening

- fixed appliances - for 3-dimensional tooth control
- 'push-pull' mechanics - involving open-coil spring in the 2 region (the 'push') and lacebacks/power chain to retract the canine (the 'pull')
- minimum space requirement for implant retained prosthesis = 6.5mm (3.5mm implant needing 1.5mm space either side)
- long cone PA needed to check for root angulation and measure inter-coronal/inter-radicular distance prior to debond
- once appropriate space has been opened, closed-coil spring or an acrylic denture tooth attached to the orthodontic archwire via a bonded bracket should be placed to maintain space
- retention - VFRs (can prevent relapse in all 3 dimensions) or Hawley-type retainer incorporating prosthetic teeth and wire stops; definitive restoration should take into account the need for long-term retention

Savarrio & McIntyre, 2005

Richardson & Russell, 2001

Space closing

- invert 3 bracket (convert -7° to +7°) or bond 2 bracket to the 3 - will torque the 3 root palatally, reducing the 3 eminence and locate the 3 root similar to the position that should have been occupied by the 2
- subtle orthodontic movements may include:
 - additional palatal root torque for the 3
 - mesial rotation of the 4 for aesthetics (bond 4 more distally)
 - 3 extrusion to allow the gingival margin to be positioned more incisally to mimic that of the 2
 - can add buccal root torque to 4's to mimic canine eminence
- retention - bonded wire retainer
- space closing considered to be more aesthetic as space opening aesthetics dependent on quality of restorative work

Thickett et al., 2007

Rosa & Zachrisson, 2001

Shroff et al., 1996

Qadri et al., 2016

Treatment mechanics (missing 5)

Space opening

- maintain lower E long-term but reduce mesial-distal width (premolarise) - check E's root morphology

Bjerklin & Bennett, 2000

Space closing

- may be incorporated into 'Xtn' pattern if malocclusion dictates, e.g. crowding present, ↑OJ
- consider controlled sectioning of lower E's to allow bodily space (hemisectioning), better success in under 9yr

Valencia et al., 2004

Long-term success of replacments

Bridges

- survival 5yrs 91%, 10yrs 83%

Thoma et al., 2016

Implants

- 5 years - 95.2%, 10yrs 80% but complications in 24%

Pjetursson et al., 2012

Recommended reading

Goodman et al., 1994; Carter et al., 2003; Khalaf et al., 2014; Gill & Barker, 2015; Silveira et al., 2016

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