**Evaluation of Abutment tooth:**
A tooth or portion of a tooth that used for the support and/or retain of a fixed bridge or part of the bridge, to which retainer is connected (cemented).

All the forces that would normally be absorbed by the missing tooth are transmitted through the pontic, connectors, & retainers to abutment teeth. Abutment teeth must withstand forces normally directed to the missing teeth, in addition to those usually applied to the abutments, therefore, the choice of abutment is important because it has to withstand both the forces acting on it and on the pontic. So the clinician have to evaluate the abutment teeth carefully.

**EVALUATION AIDS**
- CLINICAL EXAMINATION USING EXAM.TOOLS
- VITALITY TEST
- RADIOGRAPHS
- DIAGNOSTIC CASTS
- PERIODONTAL PROBE

**Requirements:**
1. Abutment must withstand the forces normally directed to the missing teeth; whenever possible the abutment should be vital tooth.
2. A tooth that has been endodontically treated & symptomatic with radiographic evidence of good seal & complete obturation of the canal can serve as abutment (Post & core for retention & strength).
3. The supporting tissue surrounding the abutment teeth must be healthy & free of inflammation.
4. The abutment teeth should not exhibit any mobility, since they will be carrying an extra load. Sever uncorrectable, periodontal disease is contraindicated For F.P.D

**Abutment evaluation (selection):**

**FACTORS RELATED TO TOOTH (ABUTMENT)**
1. Health of abutment (caries or pulpal):
   - A sound abutment tooth permits ideal type of preparation. Caries tooth may be used as abutment provide that caries is removed the pulp protected (lining) and the tooth is restored to its original form by suitable filling material.
   - If the caries far away from margin and small and the retainer design will extend beyond the caries area, cement or resin can't be used in state of metal.
Extensive caries need extraordinary filling technique and preparation to conserve and support remaining tooth structure.

Pulpless teeth can be used only after endodontic treatment.

2. SHAPE;

Some teeth have conical, peg, bulbous or tapered crown form that interferes with the preparation parallelism, necessitating full coverage crowns to improve aesthetics and retention. • Examples:

- Peg laterals
- Anterior teeth with poorly developed cingula and short proximal walls
- Mandibular premolars with poorly developed lingual cusps and short proximal surface
- Thin incisors.

3. CROWN LENGTH

- The abutment teeth must have adequate occlusocervical crown length to achieve sufficient retention.
- Full coverage restorations and crown lengthening are considered with short clinical crowns to ensure adequate retention.

3. Size of the crown:

- **It determines the type of retainer to be used. For example: short, thin, conical, tapered teeth are poor indication for partial veneer crown.**
- **The height of the clinical crown is closely related to retention.**

4. Axial relationship:

a) Rotation, tilting, over lapping, mal-position might lead to decision of precluding of such a tooth to be used as abutment (because rotation or torque can damage supporting structure or cause retainer to become loose).

b) Also it may indicate the use of specific retainer (over reduction lead to weaken the tooth & endanger pulp health).

c) Rotation lead to either increase or decrease of space available for pontic (size of pontic planned).

FACTORS RELATED TO ROOT & GINGIVO PERIODONTAL COMPLEX

5. Condition of supporting tissue;

- The supporting tissue surrounding the abutment teeth must be healthy & free of inflammation, the abutment teeth should not exhibit any mobility, since they will be carrying an extra load. Intra oral radiograph should be used to evaluate bone architecture

- The alveolar bone support is one of most important factors that aid to evaluate an abutment

- The supporting alveolar bone should be healthy

- It should have good trabecular architecture and show no sign of bone defect or bone loss

The roots & supporting tissue should be evaluated for the following:

A. CROWN - ROOT RATIO
B. ROOT CONFIGURATION
C. PERIODONTAL AREA

A. Crown –root ratio:

- It is a linear measurement of the length of the crown (tooth) occlusal to the crest of alveolar bone.
- 2/3 crown/root ratio is the optimum for a tooth to be used as abutment for F.P.D.
- Minimum acceptable ratio is 1:1 crown/root ratio
- Greater than 1:1 might considered adequate in some cases such as periodontally involved mobile teeth (opposing) or if the opposing occlusion is composed of artificial teeth, which reduce occlusal forces that acting on abutment, this defiantly lead to less stress on abutment.

B. Root configuration; (Root shape, angulation & length)
- Roots that are broad labio-lingually than they are mesio-distally are preferable roots that have round or circular in cross section.
- Tooth with conical root can be used as abutment for short span bridge. A single rooted tooth with irregular configuration or with some curvature in the apical third of the root is preferable to the tooth that have perfect taper.
- Multirooted teeth generally provide greater stability than single-rooted teeth.
- A multi rooted posterior teeth with widely separated (divergent) roots will offer better periodontal support than root that converge, fuse, or have conical configuration.
C. **Surface area of the roots:**
- The area of periodontal ligament attachment of the root to the bone.
- It can be used as a measurement scale to determine the potency of abutment.
- Tylman stated that two abutment teeth could support two pontics.
- Johnston et al improvised Tylman statement and proposed the famous Antes law.

**ANTE’S LAW:**
The root surface area of the abutment teeth (*embedded in bone*) *(periodontal ligament area/pericemental area)* must be equal or more than root surface area of teeth being replaced.

**Example:**
*missing first molar second premolar, the root surface areas of both are equal to the root surface area of abutment (second & first premolar). So bridge can be done with risk.*
BIOMECHANICAL CONSIDERATIONS FIXED PARTIAL DENTURE

SPAN LENGTH

All F.P.D. flex slightly when subjected to a load, the longer the span, the greater the flexing. **It is not linear relationship but varies with the cube of the length of the span.** Thus if other factors being equal, if a span of single pontic is deflected in a certain amount, a span of two similar pontics will have **eight times** as much, **three pontics** may move **27 times** as much, **this mean replacing three missing posterior teeth with F.P.D. rarely has favorable prognosis, especially in the mandibular arch (Treatment with R.P.D. or implant supported prosthesis).**

- Excessive flexing under occlusal loads may cause failure of a long span F.P.D., It can tend to:
  - Fracture of porcelain veneer
  - Connector breakage
  - Retainer loosening and caries
  - Unfavorable tooth or tissue response.

All these render prosthesis failure.

Span Length:
**Distance between abutments affects the feasibility of placing fixed prosthesis**

- Ideal for 1-2 missing teeth
- loss of 3 adjacent teeth requires careful evaluation of other factors (crown-root ratio, root length and form, periodontal health, mobility, occlusal force and biomechanical factor)

- When long span F.P.D. fabricated:
  - Pontics & connectors should be made as bulk as possible to ensure optimum rigidity without jeopardizing gingival health.
  - The prosthesis should made be of a material that has high strength & rigidity.
Arch curvature:
It imposes additional stress on F.P.D. It has effect on the stress occurring in F.P.D. when pontics lie outside the inter abutment axis line. The pontics act as lever arm, which produce a torquing movement. This is common problem in replacing all four maxillary incisor.

A common problem in replacing all four maxillary incisor with F.P.D. & most pronounced in the pointed taper arch anteriorly (the more the circular the arch curvature the less will be the problem). As seen in figure, the pontics lies outside the inter abutment axis line as result the pontics will act as lever arm that can produce torquing movement, the more the taper the arch the longer will be the lever arm and the more will be the stress or torquing force (forces directed against a maxillary incisor pontic will tend to tip the abutment teeth due to curvature of the arch. To solve such problem and in order to offset the torque, additional retention is obtained in the opposite direction from the lever arm & at distance from the inter abutment axis equal to the length of lever arm, this mean, that two abutment teeth at each end of long span anterior FPD must be used in order to resist this tipping forces. This mean first premolars are used as secondary abutments for a maxillary four pontic canine-to-canine FPD.

Thus, in cases of pointed taper arch anteriorly when replacing four maxillary incisors, the clinician should generally use canines & first premolars as abutment teeth.

Pier (intermediate) abutment:
Edentulous spaces can occur on both side of the abutment tooth creating alone free standing pier abutment. In such case, Forces transmitted to terminal retainers as a result of middle abutment acting as a fulcrum, causes failure of weaker retainer.

To overcome such complication:
1) Such F.P.D. needs extremely retentive retainers.
2) Use of non-rigid connector.
3) When periodontal support is adequate, a much simpler approach would be to cantilever one segment of the bridge on one side of pier abutment.
To overcome such complication:
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- **Tilted molar abutment:**
  Tilted second molar lead to difficulty or impossibility to make satisfactory F.P.D. because the positional relationship no longer allow for parallel path of insertion without interference with adjacent teeth.

To solve this problem:
- **Ortho treatment** (up righting the tilted tooth)
- **Using proximal hall partial crown as a retainer on tilted molar abutment.**
- **Using telescope crown and coping as retainer.**
- **Non rigid connector is another solution to the problem.**
SPECIAL PROBLEMS: Tilted Molar Abutment

To solve this problem:

1) Ortho treatment
2) Using proximal half partial crown as a retainer on tilted molar abutment.
3) Using telescope crown and coping as retainer.
4) Non rigid connector is another solution to the problem.

Evaluation of the path of insertion
Path of insertion should be check before imprint. Parallelometer – mirror can be use foe such porpose especially in difficult case or in experenice dentist, Parallelometer - mirror can easily spot the positional relationship of the prepared abutments.