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Designed by: Hind Alabbadi

Crown-Root Fracture

 In this lecture we'll continue talking about traumatic injuries to permanent anterior teeth; crown-root fracture. Crown-root fracture with pulp involvement "complicated" injury can be defined as: A fracture involving enamel, dentin, and cementum with loss of tooth structure, and exposure of the pulp where the fracture line extends subgingivally to involve the root.

 This type of injury has a poor prognosis as the fracture line is extended to affect the root; the main problem is not the involvement of the crown but the involvement of the root which make the condition difficult to treat. The prognosis and the management of this type of injury depend on the extension of the fracture line on the root; the more extensive the fracture line -apically- the more difficult the management.

 In the management of crown-root fractures there are four possible scenarios can be followed according to the type and extension of the injury:

1. Surgical extrusion of the remaining part of the root.
2. Gingivectomy and gingivoplasty; if the fracture line is near the cervical part of the tooth-not extending deeper apically.
3. Extrusion by orthodontic treatment.
4. Extraction .

 In every case with crown-root fracture you should give a trial to preserve the tooth, extraction may be the type of management followed if the other approaches failed to preserve the tooth.

 The decision on which approach to follow depends on the clinical examination and radiographic interpretation, usually an emergency treatment is provided until a definitive treatment plan is determined. An emergency treatment may include: splinting of the fractured mobile segment by itching both parts and composite bonding in order to reduce pain and prevent interference with occlusion, partial pulpotomy especially in young patients with open apices and preserving pulp vitality is critical. Later one of the previous approaches may by performed after determining the treatment plan.

**1st Senario** : Surgical extrusion of the remaining part of the tooth:

 After removing the mobile fractured part of the tooth in a case of crown-root fracture that extends far apically it may be indicated to perform surgical extrusion of the tooth; moving the remaining part of it in a more coronal position or what is called "intraalveolar transplantation".

 In this procedure the clinician starts with injecting LA then with a scalpel blade an incision is made on the gingiva palatally starting cervical in order to gain access to the root. The forceps is then used to "extract" the root with the remaining part of the crown, then repositioning it in a more -coronal- position within the alveolar process.

 This procedure aims to place the coronal edge of the fractured root in a supra-gingival position which make the restoration of the tooth possible. As the root becomes loose in its new position we can rotate it in any direction around its long axis, this may be indicated for the ease of manipulation and restoration e.g. rotating the tooth 90O in order to make the exposure direction labial instead of proximal. The tooth can be splinted now to the adjacent teeth by itching and composite bonding and by this it is easier for the clinician to do RCT for the remaining root and then restore it with post-retained crown.

 In the past it was recommended to use non-setting calcium-hydroxide in the canal for six months before obturation with Gutta Percha in order to provide aseptic environment but this was found to cause external/internal root resorption and dentin/cementum dissolution. However, the new recommendation is to use non-setting calcium-hydroxide as an antibacterial for one week only.

Notes:

* After repositioning the crown it may become higher than the adjacent teeth crowns especially if the fracture only involved one side of the tooth, in such a situation the clinician should cut the excess part of the crown after splinting.
* Surgical extrusion is indicated only when the remaining part of the root is long enough to support a post, otherwise the remaining root should be extracted.
* One advantage of this technique is the ability to visually assess the root for the presence of any undiagnosed fractures before repositioning.

2nd Scenario : Gingivectomy and Gingivoplasty:

 The typical presentation for this scenario is: Crown-root fracture which involve mainly the palatal part of the crown and with a fracture line extending palatally to end within the cervical third of the root. In this situation most of the labial part of the tooth is preserved and can support a crown. In order to expose the subgingival fracture line palatally gingivectomy should be performed and then gingivoplasty, the tooth is then restored with a temporary crown after performing RCT. After two weeks gingival creeping "migration coronally" can be observed and the tooth can be restored with a post-retained crown.

Note: in some situations it may be essential to perform ostectomy and osteoplasty in addition to gingivectomy and gingivoplasty.

The Dr didn't mention examples on the third and fourth scenarios written above.

Root Fracture

 Root fracture is a comlex pattern of injury that doesn’t involve cementum, dentin and pulp only but sometimes the fracture may affect the periodontal ligament and the alveolar bone. A fracture is defined as a root fracture if the fracture line is horizontal and completely sub-gingival, this line could be within the apical, middle or cervical thirds of the root.



 Most cases of root fracture occur after age of ten years as the bone become rigid and the tooth apex is close, while before age of nine years most cases of severe trauma results in avulsion/loss of the tooth because the bone is resilient and the tooth is with open apex, it is rare to see a case with root fracture in young children.

 Cases of root fracture can heal by one of four possible ways:

1. Healing by hard tissue: The best one; cells from the pulp will migrate between the two separated segments of the tooth and start to lay down cementum, dentin and hard tissue components to connect the two segments together.
2. Healing by connective tissue: A good one; cells from the periodontal ligament will migrate between the two segments and form connective tissue, few months later this will convert to hard tissue.
3. Healing by mixed hard-connective tissue: As the ingress of cells is from both the pulp and the periodontal ligament.
4. Formation of granulation tissue: The worst one; where an infection reaches the area of fracture healing will be hindered and granulation tissue will form between the two segments. In this situation the tooth should be extracted.

 In the diagnosis of root fractures the clinician can benefit more from a cone beam images as the plain x-ray images frequently hide the fracture line especially when the x-ray beam runs parallel to the fracture line. If there are clinical signs of root fracture clinically " luxation or subluxation" and the conventional x-ray didn’t show any fracture the clinician should tilt the source of radiation/cone between 10o and 15o  upward or downward to get a different angle.

Treatment of root fracture: It depends on the location of fracture line:

 **Apical root fracture**: most of the cases need no treatment as the crown is immobile and the patient is only followed up for at least two years to assess healing. This is because fractures in the apical third will not sever the blood vessels as the edges of the injury are fixed and vasculature has the property of elasticity. If infection occurred in the case of apical root fracture then RCT should be performed along with apicoectomy for the apical part.

 **Middle and cervical root fractures**: one common sign for these cases of injury is the displacement of the crown palatally at the time of examination. in addiotion, the tooth makes dull sound on percussion. The treatment of choice for this type of fracture is repositioning/reduction of the crown to its original position and splinting and fixation to achieve healing. Its quit common for these teeth to respond normally to sensibility tests as the neurovascular supply is still intact.

Note: Sometimes root fracture could be accompanied by labial bone plate fracture and displacement palatally, in these cases the tooth may become "locked" between the two plates and may give a false negative metallic sound on percussion. If the tooth is locked the clinician should inject a LA agent before repositioning/reducing the tooth.

 **Marginal breakdown/Segmental bone fracture**: is a fracture of the labial or lingual plate of alveolar bone; in some cases a sudden breakdown and resorption occurs without obvious cause. These situations happen as a result of segmental trauma; a trauma that cause fracture to the bone not to the teeth where the plate of alveolar bone moves along with a group of adjacent teeth e.g. central, lateral and canine as a single unit. In this case the segment and the teeth are repositioned and fixed/splinted for two to four months.

 **Remember** : Avulsed tooth with closed apex should be splinted for 7 to 10 days.

 **Other** than the above mentioned numbers **all** types of trauma including "intrusion, extrusion, lateral luxation, subluxation, cervical/middle root fractures" should be splinted for 3 to 4 weeks.

 Splinting is the topic of the second part of this lecture; there are different types of splinting but the most important are: direct splinting and wire splinting. Direct splinting is achieved by acid itching of two incisal angles of the crown in order to bond them by composite to two neighboring teeth.

Notes:

* In order to understand/clarify some points I referred to the internet and added some information.
* I changed a bit the order of the lecture topics for easier understanding.
* There is another part of this lecture .

Good Luck