How to treat a cracked, but still inact, cusp.

1 Full coverage crown. >>

- **Advantages.**
  - Encircles crown and acts as a splint holding all sections together.
  - Distributes occlusal forces over entire tooth and minimises forces being relayed to the crack.
  - Provides option of placing margins more apically and therefore providing more bracing for the tooth.

- **Disadvantages.**
  - The crown preparation procedure can add extra trauma to the pulp of a tooth with a cracked cusp that is still in place.
  - Around 20% of the teeth with reversible pulpitis associated with the crack prior to crown preparation, have been found to require root canal therapy at a later stage. The majority of these treatments were required within 6 months of crown placement. This is higher than experienced by teeth in the same category but restored with a more conservative restoration.

**Comment:**

Teeth with a cracked, but unbroken, cusp and displaying signs of reversible pulpitis have an increased chance of requiring endodontics after full crown placement. Thought should be given at the outset to the type of full crown to be used. Access cavity preparation in porcelain-fused-to-metal or full metal crowns may be easier and cause less longer-term problems than similar preparations in all-ceramic crowns.

2 Ceramic onlay (conventional/CAD-CAM). >>

- **Advantages.**
  - Involves less tooth reduction than would be the case if a full crown is used.
  - More aesthetic alternative to a metal onlay.
  - If a CAD-CAM preparation technique is used, the cavity preparation is less conservative than required for metal onlays and some direct resin-composite restorations.
  - Can be difficult to match colour of remaining tooth structure if used in situations where aesthetics are important, for example if capping the buccal cusp of an upper first premolar.
  - If endodontics is subsequently required the preparation of an access cavity may result in the ultimate need to replace the onlay.
  - Ceramic onlays do not have a good long-term track record. One study showed a 24% failure rate over 11 to 15 years. Porcelain is brittle and can show signs of fracture with little or no plastic deformation. Over one-third of the failures in the above study were due to ceramic fracture.

- **Disadvantages.**
  - The cavity preparation can be prepared and placed in one appointment. This overcomes the problem of having to use a temporary restoration which can increase the risk of microleakage and pulpal complications.

The use of a ceramic onlay capping the affected cusp is one approach.
How to treat a cracked, but still intact, cusp. (cont)

2 Ceramic onlay (conventional/CAD-CAM). (cont) >>

Comment:
- In view of the other alternatives available, ceramic onlays may not be the most viable option for restoring a tooth with a cracked, but unbroken, cusp.
- Dental porcelains used to produce ceramic onlays are hard but brittle materials. Their relative inability to absorb compressive loading forces raises the potential for untoward forces being placed on the cusp-fracture area.

3 Resin composite onlay (conventional/CAD-CAM). >>

Advantages.
- Good track record for treating painful cracked teeth. They have been found to work well if the original restoration is first replaced with a directly bonded resin composite before onlay preparation is carried out.
- More aesthetic alternative to a metal onlay.
- If a CAD-CAM preparation technique is used with a resin-composite block, such as a Paradigm™ MZ100 Block (3m Espe), the restoration can be prepared and placed in one appointment. This overcomes the problem of having to use a temporary restoration which can increase the risk of microleakage and pulpal complications.
- Materials are easy to repair and adjust in the mouth.
- Good fracture resistance and better ability to absorb occlusal forces than ceramic inlays.

Comment:
- The use of a resin-composite onlay is another approach.
- The cavity preparation is less conservative than required for metal onlays and some direct resin-composite restorations.
- Restorations milled from resin-composite blocks can be difficult to match to the colour of remaining tooth structure if used in situations where aesthetics are important. The colour match can be improved if resin composite is added to the facial-surface section. However, the major disadvantage of this approach, is that the facial surface of the onlay has to be cut back by 1.0 to 1.5 mm before the additional resin is added.

Tip:
- If an onlay is planned that will require separate preparation and fitting appointments, a simple precaution may be worthwhile:
  - Before doing the onlay preparation remove the old restoration and place a bonded resin-composite one. This has the effect of bonding the affected cusp to sound tooth structure and minimising the chances of cusp fracture in the between-appointment period.

Source: www.dentaloutlook.com.au
How to treat a cracked, but still intact, cusp. (cont)

4 Gold/metal onlay. >>

- **Advantages.**
  - Can be a very conservative, minimally invasive preparation.
  - Less tooth reduction required than for ceramic or indirect resin-composite onlays.

**Comment:**
A proven conservative approach for restoring a tooth with a cracked, but unbroken, cusp.
The main disadvantage is that the display of gold/metal may not be acceptable to some patients.

5 Direct resin composite restoration. >>

- **Advantages.**
  - A straightforward one-visit procedure that has been found to eliminate thermal sensitivity and pain on biting.
  - Very conservative preparation: only the affected cusp is reduced.
  - High success rate over 6 to 7 years when resin composite bonded with a 3-step etch and rinse dentine-bonding agent.
  - Resin composite appears to protect affected cusp through a ‘shock-absorbing effect’ and >

**Advantages.** (cont)
- Availability of surface treatments that allow resin and resin-modified glass-ionomer cements to bond to the metal, thus allowing onlays to be bonded in place.
- Less invasive tooth preparation should mean less trauma to pulpal tissues.

- **Disadvantages.**
  - May not be preferred in some situations because of the possible display of metal/gold.

**Tip:**
A bonded resin composite restoration capping the affected cusp can be an effective restoration.

- **Tip:**
To ensure maximum support by the resin composite restoration for the cracked cusp area, after reducing the cusp place a 45 degree bevel on the enamel margin. This gives a larger enamel area to bond to.

Source: www.dentaloutlook.com.au
How to treat a cracked, but still intact, cusp. (cont)

5 Direct resin composite restoration. (cont) >>

Comment:

An immediate, straight-forward way of restoring a tooth with a cracked, but unbroken, cusp. Only the affected cusp needs to be reduced. Clinical trials indicate good longevity and a relatively quick resolution of thermal sensitivity and pain on chewing.

6 Bonded amalgam restoration. >>

- Advantages. 1

  A bonded amalgam restoration capping the affected cusp can be an effective restoration.

  A bonded amalgam restoration only requires a 2 mm cusp reduction compared to 4 mm for a pinned amalgam restoration.

  - Bonded amalgam found to reduce thermal sensitivity better than a pinned amalgam possibly due to sealing effect of bonding resin on the crack and dentinal tubules.

Comment:

Use of a bonded amalgam restoration is preferable to a pinned restoration.

An immediate, straight-forward way of restoring a tooth with a cracked, but unbroken, cusp. Only the affected cusp needs to be reduced. Clinical trials indicate good longevity and a relatively quick resolution of thermal sensitivity and pain on chewing.

Appearance of the restoration may be a disadvantage to some patients.

- Advantages. (cont)

  - A bonded amalgam appears to protect affected cusp through a ‘shock-absorbing effect’ and by directing occlusal forces away from the area.

- Disadvantages. 1

  - Poor aesthetics.

  - Level of tooth reduction of the affected cusp invariably greater than that required for a metal/gold onlay.

Tip:

When placing a bonded amalgam restoration the bonding agent, Clearfil DC Bond (Kuraray), has been found easy to use and appears to provide a very good bond.

Technique: 6

1. Mix equal parts of Clearfil DC Bond liquids A and B.

2. Apply to preparation, then after 20 seconds blow dry under a strong air flow. (Keep unused mixture protected from the light).

3. Light cure.

4. Apply another layer of the mixture and gently air dry to evaporate the solvent. Do not light cure.

5. Pack the amalgam onto the uncured layer.
A cusp-protection method. Although there are no published clinical studies as to efficacy, the following technique developed by Dr Graham Mount may be worth keeping in mind.

**Background:** On the occlusal surfaces of posterior teeth the cuspal inclines face inwards. This means that when the cusp of the opposing tooth comes into occlusion it exerts a wedging action on these inclines.

Recognising this, Mount developed a cusp-protection method for MOD cavities that is conservative and eliminates this wedging effect. The walls of the cavity preparation are leaned outwards from the gingival floor. Once a rigid restoration is placed the occlusal forces are directed apically through the restoration and away from the cusps (see below).

Because the cuspal inclines face inwards they can experience a wedging action from a cusp of the opposing tooth.

In the Mount method the cavity preparation is modified so that the buccal and lingual walls of the preparation lean outwards from the gingival floor. The lingual cusp may be reduced as shown.

Once a rigid restoration is bonded in place the occlusal forces are directed away from the cusps and into the restoration itself. If necessary, the lingual cusp is given up to 2 mm of coverage.

**Guide to high risk sites for cusp fracture.**

As the diagram shows the high risk sites for a cracked cusp in the upper arch are the buccal cusps of the upper first and second premolars. In upper molars the diagonally placed cusps, the mesiofacial and distolingual, are in the moderate to high risk sites for a cracked cusp.

In lower posterior teeth the lingual cusps of the lower first and second molars are the prime sites for the equivalent situation.
How to treat a cracked, but still intact, cusp. (cont)

**Summary**

The restorative options for a tooth with a cracked, but unbroken, cusp are:

- **Full crown:** Splints sections of tooth together. However, it has been found that there is a relatively high requirement for endodontic treatment after crown placement in teeth with a history of reversible pulpitis associated with the crack.

- **Ceramic onlay:** Not the best choice. This type of restoration does not have an impressive track record when used in these cases.

- **Indirect resin composite onlay:** Although the cavity preparation is not particularly conservative, this type of restoration has demonstrated a good performance when used to restore teeth with a cracked, but unbroken, cusp.

- **Gold/metal onlay:** In terms of the conservative cavity preparation required and good physical properties, it is an excellent choice for these cases. The main disadvantage is the display of gold/metal in situations where aesthetics are of importance.

- **Direct resin composite restoration:** Provides an immediate solution to the problem. Only requires affected cusp to be included in the restoration. Has demonstrated a very good performance when bonded with an etch and rinse bonding agent.

- **Bonded amalgam restoration:** As with a direct resin restoration it provides an immediate solution to the problem. Has a good track record. Main disadvantage is that it cannot be used in situations where aesthetics are of importance.

- **Cusp-protection method:** May provide a conservative approach, particularly for upper premolar teeth. Facilitates obtaining good aesthetics, especially if the buccal cusp is the affected cusp.

**References:**