Failure of crown & bridge cases (reasons and solution)

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Introduction

There are many causes of crown and bridge failure, starting with the entrance of the patient to the dental clinic, passing through the diagnosis, all the clinical and laboratory steps, and even after inserting the restoration for a short or long period of time during service.

Provided the bridge is well planned and constructed and the patient is with good oral hygiene and is conscientious, the chances of failure are small.

Patients always ask 'how long this bridge or crown will last?', this is an important question to answer as most bridges do not wear out, neither do the supporting teeth. Failure is the result of isolated incident.

Isolated incidents, such as a blow, cannot be predicted and may occur at any time. The prevention of caries and periodontal disease is largely under the control of the patient and assisted and monitored by the dentist and hygienist. Changes affecting caries and periodontal disease likewise cannot be predicted.

These include dietary changes, drugs inducing dry mouth and geriatric changes which make cleaning difficult.

Clinically, the causes of failure are:(6)

1. P.D.D. 21.2%
2. Poor esthetic 18.7%
3. Caries 15.4%

4. Dislodgement 10.2%

5. Defective margins 9.9%

6. Veneer failure 7.5%

7. Metal perforation 5.6%

8. Broken solder joints 3.8%

9. Broken pontics 2.0%-

10. Fractured abutments 1.7%

11. Mobility of abutments 1.3%

12. Occlusal problems 1.1% **(Zakaria & Al-Hashemy)**

Causes of failures

1.Loss of retention.

2.Design failure.

3.Mechanical failure.

4.Change of the abutments.

5.Inadequate clinical or laboratory technique.

I. Loss of retention

1-Inadequate tooth preparation.

2-Impression deformation.

3-Overmuch spacer material on the die.

4-Deformation of metal cast on the abutment teeth.

5-Bad technique of cementation (inadequate isolation, poor mixing, presence of remnants that interfere with retention).

6-Solubility of cement due to open margin or a perforation in the bridge.

7-Caries, which causes leakage at the margin.

In the case of simple cantilever bridges with one abutment tooth or the major retainer of three-unit of fixed-movable bridge, or both ends of fixed-fixed bridge, loss of retention will result in falling out of the bridge, so there will be less permanent damage as plaque is retained against the surface of the preparation and the patient is obviously aware of the problem and seeks treatment quickly.

II. Design failure

1- Abutment preparation design:

Inadequate crown preparation is a common cause of failures:

i. Taper of preparation, when it exceeds 20° (ideal 5°-10°) failure through loss of retention.

ii. Inadequate path of insertion leads to the finished restoration cannot be seated.

iii. Insufficient reduction at the margin leads to overbuilt crown producing a plaque retention area at the margin.

iv. The sharp unrounded external angles of crown preparation may lead to:

- The stone die materials may not flow into the sharp angles of the impression → bubbles.
- The sharp edges may be damaged at the wax-up stage.

- Investment material may not flow adequately into the wax pattern.
- It may be difficult to remove entirely the investment material from sharp internal angles without damaging the casting.
- Cement will flow less readily around sharp angles increasing the likelihood of unnecessary thick cement layer at the margins.

2- Inadequate bridge design:

Designing bridges is difficult, it is neither a precise science nor a creative form of art. It needs knowledge, experience and judgment, which take years to accommodate.

Simple classifications of these failures are:

a. Under-prescribed bridges

These include designs that are unstable or have too few abutment teeth, ex: a cantilever bridge carrying pontics that cover too long span, or a fixed-movable bridge where again the span is too long, or where abutment teeth with too little support have been selected.

b. Over-prescribed bridges

Cautious dentists will sometimes include more abutment teeth than are necessary retainer, which fail:

- The 1st lower premolar might be included as well as the 2nd premolar and 2nd molar in a bridge to replace the lower 1st molar; this is not necessary.

- Upper canines and both premolars on each side are replacing the four incisors. As well as being destructive, this gives rise to unnecessary practical difficulties in making bridge.

The retainers themselves may be over-prescribed with complete crowns being used where partial crowns or intracoronal retainers would have been quite adequate, or metal-ceramic crowns might be used where all metal crowns ~~would have been~~ sufficient.

III. Mechanical failure of crown or bridge components (7)

Typical mechanical failures are:

1- Porcelain fracture
2- Failure of solder joints
3- Distortion
4- Occlusal wear and perforation
5- Lost facings

1. <u>Porcelain fracture</u>

At onetime pieces of porcelain fracturing off metal-ceramic crowns, or the loss of the entire facing due to failure of metal-ceramic bond.

i. Inadequate thickness of metal.

ii. Excessive thickness of porcelain contributes to inadequate support and predisposes to eventual fracture. This is often true in the cervical portion of a pontic. A reliable technique for ensuring uniform thickness of porcelain is to wax the

fixed prosthesis to complete anatomic contour and then accurately cut back the wax to a predetermined depth.

iii. The metal surfaces, to be veneered not smooth and not free of pits, surface irregularities will cause incomplete wetting by the porcelain slurry, leading to voids at the porcelain-metal interface that reduces bond strength and increases the possibility of mechanical failure.

iv. Sharp angles on the veneering area must be avoided. They produce increased stress concentration that could cause mechanical failure.

v. Any deformation of the metal framework at the junction can lead to chipping of porcelain; for this reason, occlusal contacts must be placed to avoid the fracture 1 or 2 mm from junction.

vi. Excessive practical function or trauma.

Long span .is more risk of the pontic area flexing →distortion, so nickel-chromium alloys (being stiffer) are perhaps more suitable for very long span bridge.

g. Improper laboratory procedures.

All porcelain crowns or bridges fracture either due to:

- Stresses are developed within P.J.C. as a result of contraction on cooling after the firing cycle. These stresses produce minute cracks, which propagate to produce failure if crown is subjected to sufficient force. These stresses are concentrated

around sharp internal angles of fitting surface (so should be rounded).

- If the fracture is due to trauma and particularly if the restoration had served successfully for sometime, it should be replaced by another all ceramic restoration. If the failure occurs during normal function, the replacement should be metal-ceramic.

2. Failure of solder joints

Occasionally, a solder joint that appears to be sound fails under occlusal loading. This may be due to:

1. A flaw or inclusion in the solder itself.
2. Failure tobondto surface of the metal.
3. The solder joint not being sufficiently large for the conditions in which it is placed.

A problem, particularly with metal-ceramic bridge work, is that too much restriction of the solder connectors (buccally, gingivally and incisally) can lead to inadequate area of solder and failure.

It is better to join multiple-unit bridges by solder joints in the middle of pontics before the porcelain is added, and strengthened by porcelain covering.

There are no satisfactory intraoral repair methods and it is not possible to resolder (the whole bridge has to be remade).

3. Distortion

Distortion of all metal bridges may occur, e.g.: when hygienic pontics are made, too thin or if a bridge is removed using too much force, when this happens the bridge has to be remade.

In metal-ceramic bridges distortion of the framework can occur during function, or as a result of trauma. This is likely if the framework is too small in cross-section for the length of span and the material used.

4. Occlusal wear and perforation

i. Insufficient occlusal preparation leads to less thickness of the metal and this may lead to perforation, which may occur in the finishing and polishing.

ii. Even with normal attrition, the occlusal surfaces of teeth wear down substantially over a lifetime.

If perforation has been the result of normal wear and it is spotted before caries has developed, it may be repaired with an appropriate restoration. Occasionally, particularly if the perforation is over an amalgam core, it is satisfactory simply to leave the perforation untreated and check it periodically.

Occlusal perforation may also be made deliberately for endodontic treatment or vitality testing.

5. Lost facings

Laboratory-made ceramic or acrylic facing may be entirely lost and with acrylic facing, wear and distortion are also common.

i- Poor retention.

ii- The facing is not protected by the metal completely.

iii- Heavy occlusion on the facing.

IV. Changes in the abutment tooth

1. Periodontal disease

Periodontal disease may be generalized, or in a poorly designed, made or maintained restoration, its progress may be accelerated locally; if the loss of periodontal attachment is diagnosed early enough and the cause removed, no further treatment is usually necessary.

However, if the disease has progressed to the point where the prognosis of the tooth significantly reduced then the crown or bridge or the tooth itself may have to be removed.

Mostly, the clinical and laboratory causes are:

a) Position of the crown margin, subgingivally margin may have better appearance initially but will often a degree of gingival inflammation which may lead to more serious periodontal disease. (أ)

b) Thick margins → poor seating of the restoration and poor axial contours that will ultimately cause periodontal problem.

c) Over-margin, which leads to a pressure on the gingival.

d) Coarse or rough margins (not smooth).

e) Remnants of excessive cementing material.

So, any defect or problem at the margins of the restoration will lead to a periodontal disease.

2. Problems with the pulp

Great care is needed to prevent pulp injuries during fixed prosthodontic procedures.

Causes of injury:

I) Temperature during tooth preparation.

II) Chemical irritation by dental material.

III) Microorganisms.

IV) Recurrent caries.

V) More reduction of tooth structure without provisional restoration.(3) Every one of them can cause irreversible pulpitis.

Despite taking the usual precautions during tooth preparation abutment teeth may become non-vital after crown or bridge is cemented. It is usually reasonable to attempt endodontic treatment by making an access cavity through the crown.

It is often difficult to gain access to the pulp chamber and remove the coronal part completely without enlarging the access cavity to a point where the remaining tooth preparation becomes too thin and weak to support the crown satisfactorily.

3. Fracture of the prepared natural crown or root

Fractures of the tooth may occur as a result of:

a. Trauma b. Recurrent caries

c. Removing the prosthesis intact by using large force.

d. Tooth structure is thin especially with pulpless teeth (so the post and core is necessary).

With a bridge abutment, it is usually necessary to remove the bridge but occasionally the abutment tooth can be dispensed with and the root removed surgically, the tissue surface of the retainer being repaired and converted into a pontic.

4. Movement of the teeth

i- Misdiagnosis and incorrect treatment planning.

ii- Trauma from occlusion.

iii- Periodontal disease.

iv- Relapsing orthodontic treatment

These causes may result in the crowned tooth or bridge abutment becoming loose.

When the cause is periodontal disease or relapsing orthodontic treatment, this must be remade.