

## Dental Perspective of Children with Cardiovascular Disease A Review

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### Abstract

Congenital heart disease is one of the most common developmental anomalies. While many such conditions are apparent in the neonate, a significant proportion do not come to light until the child is older, or even later on in adult life. Medical history is mandatory prior to the treatment. Children will have Low irregular fever, with sweating, malaise, anorexia, weight loss and arthralgia. Pulp therapy of the primary tooth is not recommended and extraction of the offending tooth is preferred. Distal shoe space maintainer not advocated. In permanent dentition, endodontic therapy may be undertaken, to reduce anxiety and minimize the risk oral sedation and nitrous oxide analgesia may be beneficial. Appointments should be scheduled in short times and in the mornings. Local anesthesia should be injected slowly and with recommended doses in each condition. Antibiotic Prophylaxis is recommended in all dental procedures involving the manipulation of gingival tissue, the periapical region of the teeth, or perforations of the oral mucosa, such as extractions, endodontic treatment surpassing the periapical limits, the placement of retraction sutures, biopsies, suture removal, the placement of brackets, or buccal cleaning operations, among other. Prophylaxis in turn is not recommended in the routine injection of anesthetic solutions in non-infected tissues, dental X-rays, the placement of removable dentures or orthodontic devices, loss of temporal teeth, or bleeding. Children who are in anticoagulant therapy hematological monitoring and cessation of therapy is important. This article discusses about etiology, clinical features and management of children with cardiovascular diseases.

**Keywords:** Bacterial Endocarditis; Children; Cardiovascular Disease; Dental Management; Rheumatic Fever

### Congenital Heart Disease

It is a structural abnormality of the heart which is potentially of clinical significance. The etiology of developmental defects of the heart is unknown. Still, cases have associated with maternal rubella during the first 12 weeks of pregnancy, and other viral infections such as measles and mumps have suggested. Congenital heart defects occur in about one-third of Mongol patients [1].

The prevalence of heart defects at birth is unknown, but by school age, with the loss of the very severe cases and the addition of mild cases diagnosed late, there is approximately 1 in 1000 children affected. Many defects are so slight that they cause no disability and may not discover until a murmur found during a routine medical examination. In the more marked case, the child may be breathless on exertion, quickly tired, and have recurrent attacks of respiratory infection. In the severe case, there is a limitation of effort, and there may be stunted growth and a failure to thrive [2].

A child with a congenital disability usually has little or no restriction placed on the activity as he has grown up with it and has learned just what is his capacity for exertion. If there is any cardiac enlargement or signs of failure, there is likely to be an embargo on organized games as these demand continued bursts of effort, which could be harmful in these particular circumstances. Another exception may be a patient with aortic stenosis as this is one condition in which sudden death may occur after severe exertion, an event that is rare in congenital heart disease [3].

These patients are expected to lead healthy lives, or as normal as possible in the more severe case. Any infection must be treated promptly and vigorously since the prevention of bacterial endocarditis, and any tendency to congestive heart failure is an essential aspect of care. A patient who has signs of heart failure may be on maintenance doses of digitalis, usually in the form of digoxin. It should take twice a day orally and which has an effect of strengthening the contractions of the heart muscle and increase its output, thereby reducing congestion on the venous side [4].

There are many types and combinations of developmental heart defects, and it is as well to have some knowledge of those that occur more commonly. The general pattern is that where an anomalous aperture occurs, the blood will flow from the side with high pressure. If, however, the defect is a barrier in the regular route, e.g. stenosis, then pressure builds up behind this, causing enlargement and may result in the reversal of the average direction of the flow. Cyanosis occurs where the anomalies allow the lungs to bypass a considerable volume of blood, which is recirculated around the body without oxygenation [5].

1	DiGeorge (22q11.2 deletion) syndrome
3	Edwards syndrome
4	Goldenhar (hemifacial microsomia) syndrome
5	Hurler syndrome
6	Kabuki syndrome
7	Noonan syndrome
8	Treacher Collins syndrome
9	Turner syndrome
10	Williams syndrome

**Table 1:** Syndromes associated with cardiovascular diseases are shown [6].

**Classification [7]**

**Conditions without cyanosis**

**Atrial septal defect**

Incidence of atrial septal defect is about 7%. It is usually a single defect with some enlargement of the right side of the heart due to the increased work needed to pump the extra blood through the pulmonary circulation. If the pressure on the right side should increase beyond that in the left, there is a reversal of flow, and this may occur when there is congestive heart failure, pulmonary hypertension, or when there is associated pulmonary stenosis. The patient is likely to develop cyanosis.

Patients with atrial septal tend to suffer from recurrent respiratory infections but are rarely the victims of bacterial endocarditis-treatment directed at the control of the pulmonary disease. Surgical repair is now a reasonably safe procedure, and the defect may be completely closed.

### Ventricular septal defect

It is one of the commonest of the developmental defects of the heart. It may occur alone or in combination with others. Its size is very variable and may be very small or so extensive as to involve most of the septum. Incidence of atrial septal defect is about 22%.

Symptoms are generally related to the severity of the defect, and mild cases may not detect until routine examination at school discovers it, the child is without symptoms at all. In others, there is a history of recurrent chest infection, fatigue, and dyspnoea on exertion. A complication may be bacterial endocarditis, and embolism to the lungs may occur. Thus, a history of recurrent pneumonia should regard with suspicion.

Treatment of a ventricular septal defect directs towards the prevention of bacterial endocarditis and heart failure in severe cases. In a considerable number of the milder defects, there is spontaneous closure. In other cases, some degree of pulmonary stenosis develops, which has the effects of reducing the flow of blood to lungs and thus protecting them against hypertension. Surgical repair of a ventricular septal defect is now possible, and insignificant defects, a synthetic graft is sometimes used [8].

### Coarctation of aorta

Reported incidence of coarctation of aorta is 6%. It is narrowing of the aorta and most commonly just below the origin of the left subclavian artery. It results in a raised pressure in the aorta above the stricture and vessels derived from it, and a reduced weight below the restraint and its derived ships. This variation in the blood pressures, which can demonstrate in the arm and leg, is a classic sign of the defect. Symptoms derive from the abnormal blood pressures, and the patients may complain of headaches, dizziness, nose bleeds, and other symptoms of raised stress in the upper part of the body, and of cold feet, intermittent claudication and other signs of poor circulation in the legs. Sometimes this defect is associated with a patent ductus arteriosus, and the blood flows from the pulmonary artery into the aorta below the stricture, the pressure being lower in the aorta in this case.

The prognosis in patients with coarctation of the aorta is not right, and most do not survive beyond middle life, usually due to the complications of the raised blood pressure in the upper part of the body. Bacterial endocarditis occurs and usually affects the aortic valves. Surgical treatment is now a possibility and best done during the second decade. It consists of excision of the defective part of aorta and anastomosis or graft to repair the loss. It alleviates the symptoms, though precautions against bacterial endocarditis and similar care are still needed [9].

### Patent ductus arteriosus

In fetal life, when the lungs are collapsed and functionless, the ductus arteriosus acts as a bypass but usually becomes obliterated not long after birth. If it persists, however, blood passes through I from the aorta to the pulmonary artery, and the amount of the blood shunted depends on the size of the ductus and the pressure difference between the two main vessels. In severe cases, symptoms such as dyspnoea and fatigue, and later left ventricular hypertrophy and congestive cardiac failure and incidence is about 17%.

Patients with this heart defect are primarily liable to bacterial endocarditis, and the vegetations situated on a direct route to the lungs, so if detached, become emboli. In such a patient, a history of pneumonia may be suspect. Systemic emboli also occur.

Surgical treatment of a persistent ductus arteriosus is relatively simple and consists of ligation or division of the ductus. The improvement in the patient's condition after the operation usually pronounced and occurs rapidly [10].

### Aortic stenosis

Incidence of aortic stenosis is 5% and it usually affects the aortic valves and obstructs the outflow from the left ventricle to the systemic circulation, increasing the work to the left ventricle. In mild cases, there are no symptoms, but in others, there is dyspnoea and fatigue. Occasionally, sudden death may occur associated with extreme physical exertion, usually with evidence of left ventricular hypertrophy. Bacterial endocarditis may be a complication.

Surgery indicated in those patients who present some degree of handicap, and the stenosed valves resected. Prevention of bacterial endocarditis is essential [11].

### Pulmonary stenosis

This defect may occur alone or with others, such as septal defects. The direct result is an obstruction to the blood flow into the pulmonary artery from the right ventricle, increasing the pressure there and causing its enlargement. In mild cases, there may cause no symptoms, but where the defect is of a significant degree, there is fatigue and breathlessness on exertion. Where very severe, even a little effort can cause distress since the blood flow to the lungs cannot be increased as it usually is in such an event. There may be some peripheral cyanosis in this type of patient as the systemic blood flow reduce, and congestive heart failure commonly occurs. Bacterial endocarditis may be a complication incidence is about 7%.

Treatment in the more severe cases is surgical, and the defective valves or infundibulum resect to reduce the obstruction, with excellent results. Other patients are conservative with regular reviews.

### Conditions associated with cyanosis

#### Fallot's tetralogy

It is the most standard type of cyanotic congenital heart disease. The four defects of Fallot are:

1. **Pulmonary stenosis:** Which obstructs the blood flow from the left ventricle into the pulmonary artery, causing a rise of the pressure in the former.
2. **Ventricular septal defect:** Through which the blood passes from right to left since the pressure on the right side is now higher than in the left.
3. **Dextroposition of the aorta:** Which may over-ride the septum in such a position that it receives directly a large part of blood entering from the right ventricle through the septal defect [11].
4. **Right ventricular hypertrophy:** Results from the rise in pressure on that side.

It should note that the extraposition of the aorta is not essential to the syndrome and that the fourth anomaly is the result of the first. The fundamental defects causing the condition are, therefore, pulmonary stenosis and a ventricular septal defect. Since a considerable volume of circulating blood bypasses the lungs, there is generalized cyanosis and clubbing of the fingers and toes.

Dyspnoea is a feature and young children develop a habit of squatting when in this condition, and very soon learn to rest for brief periods as needed. As in any cyanotic condition, the patient tends to somewhat stunted in growth. Also, there is polycythemia and, consequently, a predisposition to thrombosis, which may affect cerebral vessels and produce hemiplegia. Bacterial endocarditis may occur.

Treatment directed at first to maintaining the patient and preventing complications such as thrombosis, bacterial endocarditis, and intercurrent infections. Surgery is indicated in many cases to alleviate the symptoms. In an older patient, it is possible to repair both the pulmonary stenosis and the septal defect by open surgery in some cases.

Other conditions producing cyanosis are pulmonary atresia with ventricular septal defect, tricuspid atresia, persistent truncus arteriosus, transportation of the great vessels, and Eisenmenger's syndrome, but all of these are rare [12].

### Acquired heart disease

#### Rheumatic heart disease (Rheumatic fever)

Rheumatic fever is an acute condition characterized by fever, polyarthrititis, heart disease, and chorea. It occurs in children and young adults with the highest incidence at about eight years, and rare under three years. It may affect more than one member of the same family, but how far this is due to a familiar environment or an inherited susceptibility is difficult to determine. Incidence of the disease is less, due to improvement in the background as well as earlier treatment of ailments generally. In a USA study, it estimates that about three school children per 1000 had rheumatic fever, and half of these have residual heart damage.

An association with hemolytic streptococcus Lancefield group A has established by rather indirect means. When rheumatic fever occurs, it always shows to follow a streptococcal infection such as tonsillitis or scarlet fever; serological tests show anti-streptococcal anti-bodies present whether there is a previous history of such virus or not. The disease is not the direction of the organism, but there is a delay of a few days to a few weeks in its onset. It appears likely to be a hypersensitivity to the body or its toxins. An alternative suggestion is that it is some type of autoimmune reaction. After the initial attack, recurrence is frequent and tend to present the same clinical pattern as the first in the predominance of symptoms relating to polyarthrititis, chorea, and carditis [13].

The disease may be acute or insidious in onset that not recognized as such. There is usually fever and malaise at first, but this may not be very marked. Arthritis occurs in nearly half of all cases and usually affects several joints though not always concurrently. The affected joints become red, swollen, and tender but often improve within a few days.

Chorea (St Vitus Dance) is a neurological manifestation in which there are abnormal and purposeless movements of the voluntary muscles, slurring of the speech, and similar difficulties. If the onset is without fever, these symptoms may first notice at school, but usually develop reasonably rapidly. They subside within several weeks. The association of chorea with rheumatic fever has questioned.

Heart damage is the most severe aspect of rheumatic fever, and all tissues of the heart may be involved in the inflammation. The severity of the myocarditis will influence the next course of the acute stage. The involvement of the valves is shared, and when the swelling subsides, there is residual scarring. Repeated attacks of rheumatic fever add to this so that there is cumulative damage [14].

On diagnosis of rheumatic fever, penicillin commenced immediately to eliminate any streptococcal infection still present. Treatment involves rest in bed, relatively prolonged when there is severe cardiac damage with a very gradual return to activity, and the patient may be given salicylates or corticosteroids in courses of some weeks duration to control the disease [14].

Prevention of a recurrence of the disease is all essential, and vigorous steps take to eliminate any focus of infection and to treat any intercurrent infection of the upper respiratory tract. It is a reasonably general rule that these patients are continued on a prophylactic course of penicillin for many years to prevent any streptococcal invasion, but this is not at a sufficient level to combat bacteremia, which occurs during surgery such as tonsillectomy and dental extractions. For these events, a full therapeutic dosage needs, and it recommends to use a different antibiotic for it.

**Residual cardiac effects**

These are the result of scarring and most commonly affect the mitral valves, either as insufficiency or stenosis. Occasionally, aortic valve damage causes regurgitation. Any of these lesions may result in enlargement of the heart and lead to failure, and there is the additional possibility of bacterial endocarditis to combat [15].

**Bacterial endocarditis**

It is a severe complication that can affect any patient with any degree of congenital or acquired heart defect. It is due to an infection derived from some focus in the body, and in 80 percent of cases, the offending organism is streptococcus viridans. The onset of the disease is insidious, probably due to the low virulence of the infecting organism, though occasionally it is sudden with fever. The usual pattern is a daily rise in temperature, the patient being “a bit of color” with loss of appetite. He is pale and listless, and there are a slowly developing anemia and loss of weight. These signs and symptoms are due to toxemia and inpatient with known heart disease; there should be an immediate awareness of the possibility of bacterial endocarditis [16-18].

Damage to the heart occurs, and vegetations develop at the site of infection, which may be a heart valve, a congenital disability, or the area immediately opposite the later. There are ulceration and destruction of the endocardial lining, and there may be an invasion into the deeper tissues. The vegetations consist of platelets, fibrin, and clumps of the infect in organism and pieces may become detached to form emboli. These cause secondary lesions in distant organs, and infarctions occur in the kidney, spleen, brain, and eye, among others, with the accompanying signs and symptoms. Where the primary heart lesion was a congenital disability with a left to right shunt, the emboli pass to the lungs rather than to other organs and may simulate attacks of pneumonia. Petechiae occur and may be sparse or profuse and may be found especially under the nails where that resemble “splinter hemorrhages” and in the buccal mucosa [19].

Treatment must be prompt to minimize heart and other damage and consists of rest and vigorous antibiotic therapy. Prevention is all-important, and for this reason, all operative procedures which permit entry of organisms into the body, especially in the mouth and throat areas in patients with heart disease, must be covered with prophylactic antibiotics. Although this complication rarely occurs with an atrial septal defect [20].

There are no special dental features in patients with these diseases except in the case of children with cyanosis. Oral reactions to prescribed drugs, including altered taste, impaired salivary function and gingival hyperplasia may be seen in cardiac patients. While abnormal growth of the periodontal tissue is mainly associated with plaque related inflammation, drugs such as nifedipine and amlodipine, have been implicated in causing gingival overgrowth, which may be brought to dental attention because of pain, bleeding or appearance [21,22].

**Gingivae:** Patients show discoloration of gingivae depending on the degree of cyanosis. Oral hygiene tends to reduced; some have a certain degree of recession. A higher incidence of white or light patches in the enamel seen (Table 2) [23].

<b>Clinical Features</b>
Low or high birth weight children have more chances of developing congenital heart disease
Color of the infant look for central cyanosis at palate, tongue and inner side of lip
Symptomatic or asymptomatic murmurs.
<b>Oral Manifestations</b>
Change in color of oral mucosa, indicating cyanosis
Delayed eruption of the permanent teeth
Striking changes in the tongue papillae and gingiva in TOP
Cleft palate, midline abnormalities
Growth abnormalities are seen in particular with VSDs
Pulp canal of maxillary incisors are found to be greatly enlarged funnel-shaped in COA
Increased incidence of dental caries in both the dentition due to high sugar content in medicated syrup
Increased incidence of periodontal diseases

**Table 2:** Clinical features and oral manifestations depicted [5].

### Dental Management

The critical feature in the children with congenital heart disease or rheumatic fever, regarding dental care, is to prevent bacterial endocarditis and recurrence of the heat. It can approach in 2 ways:

1. Maintenance of mouth, which is free from sepsis all the time.
2. Prevention of bacteremia results from certain forms of treatment, especially exodontia, endodontics, and periodontal treatment.

Morning appointments are preferable; there is less time for the patient to become anxious, and more time to take effective measures if peri-treatment problems occur. Every effort should be made to keep procedure time down to a minimum, and treatment should be terminated early if the patient becomes overly anxious. If angina or other significant symptoms develop, all treatment should stop, and the practitioner should be prepared to initiate emergency care. Healthy teeth and gums are important for everyone—especially for children with heart conditions.

Young children with congenital heart defects (CHD) are at greater risk for tooth decay because their baby teeth may have weak enamel. Children with cyanotic heart disease may have weaker teeth due to poor oxygenation. Cardiac medications that may cause dry mouth can also increase risk for cavities. There are complicated background factors often associated with nutrition, medication, and the demanding situation of these children's families that all play a part in their dental health.

### Conservation

- Patients should be seated comfortably (semi-supine) in the dental chair.
- Ideally, dental treatments should be provided in the morning, during short appointments, with 2 - 4 week intervals between these.
- Patient's oral cavity should be rinsed with 0.2 chlorhexidine gluconate before any dental procedure.
- There is no evidence that standard conservative procedures or local anesthesia as used for them produce any degree of bacteremia. Therefore, they can be performed usually [25-27].

Fissure sealant placement may be appropriate, depending on age and cooperation, but should consider as soon as it is feasible. Placement of resin-modified or conventional glass-ionomer. Sealants may be well-thought-out as an interim measure for teeth particularly at risk of caries that are not yet fully erupted, or for children who are not capable of bearing the placement of a conventional resin sealant [28].

Restorative treatment should be definitive, and the placement of stainless steel crowns (SSCs) is often preferable to direct intracoronal restorations, particularly for carious primary teeth. The SSC is exceptionally durable, relatively inexpensive, subject to minimal technique sensitivity during placement, and offers the advantage of full coronal coverage. Their strength as restoration is hugely constructive, but perhaps their most useful feature is their ability to protect the remainder of the tooth from caries attack for its lifetime [29,30].

The management of first permanent molars of poor prognosis is always a challenge. These teeth may have been affected by caries and molar/incisor hypomineralisation (MIH). Regardless of the cause, appropriate care of these teeth can involve sealants, temporary restorations (with materials such as glassionomer), direct restorations (such as composite and amalgam), indirect restorations (such as SSCs, onlays, and inlays), and extraction. A clear-cut decision tree has suggested as an outline for the management of molars exhibiting MIH, with decisions based on the varying degrees of severity and treatment needs over time [31,32].

**Endodontics**

There is evidence from case reports stating that the development of bacterial endocarditis after endodontic treatment, especially during pulpal extirpation in vital/nonvital teeth.

**The conditions in which endodontic treatments in children may do suggest as follows:**

- Absence of inflammation or any periapical infections.
- A completed apex.
- Instruments must confine within the root canal with no penetration of the apex.
- Antibiotic cover during the treatment.
- Radiographic check of the periapical tissues once in a year without any fail.
  
- Vital pulpotomy in an incisor with an OPEN APEX would be acceptable under a regular checkup, and the procedure does under good antibiotic coverage [33].

**Periodontal treatment**

- There is much evidence that bacteremia results from gingivectomy and scaling
- The more extensive the trauma, the more severe is the bacteremia.
- Even after light scaling, many patients show a positive blood culture. Hence all the periodontal procedures should be performed in several visits under a good antibiotic coverage [33-36].

**Extraction**

- It is a well-known hazard for patients with heart disease and rheumatic fever and must always do under proper antibiotic coverage (Table 3).
- If several teeth need to remove, it is wise to reduce the trauma by doing them in more than a single visit.
- Local anesthesia may be used generally for these patients with no exclusion of adrenaline from it unless the concentration is more than the usual 1:80,000.

Clinical situation	Single dose regimen (30-60 min before procedures)	
Via oral	Amoxicillin	50 mg/kg
Unable to take oral drugs	Ampicillin or Cefazolin or Ceftriaxone (IM or IV)	50 mg/kg
Allergic to Penicillin or Ampicillin (via oral)	Cephalexin or Clindamycin or Azithromycin or Clarithromycin	50 mg/kg
		20 mg/kg
		15 mg/kg
Allergic to Penicillin or Ampicillin (unable to take oral drugs)	Cefazoline or Ceftriaxone (IM or IV) or Clindamycin (IM or IV)	50 mg/kg
		20 mg/kg

**Table 3:** Antibiotic prophylaxis regimens for dental procedures in children-adapted from AAPD [43] and Zavala-Cornejo., et al [44].



Post-operative extraction bleeding controlled by additional local hemostatic measures such as placement of hemostatic gauze, sponges, and sutures. Rinsing should avoid the following extractions.

### General anaesthesia

- Many cardiologists usually prefer their patients with definite heart lesions to be performed under general anesthesia to avoid risk factors.
- If general anesthesia is needed, then the specialist should be consulted as to the condition of the patient and his wishes in the particular case.
- Conscious sedation may be considered, particularly for those with coronary artery disease. Special consideration should be given as to whether adrenaline-containing local anaesthetics are really necessary in view of the potential problems [37].

Orthodontic treatment, including the placement of space maintainers, can be provided for children with CHD, but only with the strictest observation and maintenance of excellent oral hygiene to reduce the risks of developing Infective Endocarditis [38].

### Behaviour-guidance

Behaviour-guidance approaches for patients with CHD can be challenging. Decisions relating to this aspect of care should not be made solely by the dentist. As for all children, communicative approaches used to introduce the child to the dental setting. For children who have little or no anxiety related to dental and medical treatment, this may be sufficient, and treatment can proceed normally [39,40].

### Cyanotic patients

- In some of these, there is a danger of thrombotic complications, and the physician may have prescribed anticoagulant drugs.
- Before taking surgery of any type, this aspect must be checked [41].

### Corticosteroid therapy

- Some patients who have had acute and severe rheumatic fever will have had corticosteroid therapy for 2 or 3 weeks.
- Before taking any form of surgery, the physician should consult.

### Heart surgery

- Before undergoing any form of surgery, it is particularly important to check that there should be no dental sepsis nor the likelihood of it in the period immediately before or after the operation.
- In some patients, the existing lesion corrected, and precautions against bacterial endocarditis need to continue for two years after the operation.
- In patients whose surgery is palliative or only deals with the existing defect, the treatment should continue as they are susceptible to bacterial endocarditis. It is essential to be sure which category applies to a particular patient [42].

Antibiotic prophylaxis recommended	Antibiotic prophylaxis NOT recommended
<ul style="list-style-type: none"> <li><b>High-risk conditions:</b> <ul style="list-style-type: none"> <li>Prosthetic cardiac valve</li> <li>Bioprosthetic Homograft</li> <li>Previous endocarditis</li> <li>Complex synoptic congenital heart disease</li> <li>Surgically constructed systemic pulmonary shunt</li> <li>Homograft</li> </ul> </li> <li><b>Moderate risk conditions:</b> <ul style="list-style-type: none"> <li>Most other congenital cardiac malformation</li> <li>Acquired valvar dysfunction</li> <li>Mitral valve prolapsed with valvar regurgitation</li> <li>Hypertrophic cardiopathy</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><b>Low or negligible risk conditions:</b> <ul style="list-style-type: none"> <li>Isolated secundum atrial septal defect</li> <li>Previous coronary artery bypass graft surgery</li> <li>Surgical repair without residual beyond 6 months, ventral septal defect and patent ductus arteriosus</li> <li>Mitral valve prolapsed without valvular regurgitation</li> <li>Previous Kawasaki disease without valvar dysfunction</li> <li>Physiologic, functional heart murmurs</li> <li>Previous rheumatic fever without valvular dysfunction, cardiac pacemakers and implanted defibrillators</li> <li>Previous coronary artery bypass graft surgery</li> </ul> </li> </ul>

**Table 4:** Recommended prophylactic coverage for dental procedure of American Heart Association [45].

Endocarditis prophylaxis recommended	Endocarditis prophylaxis NOT recommended
Dental extraction	Restorative dentistry – restoration of decayed teeth, replacement of missing teeth (operative or prosthodontic) with or without retraction cord
Endodontic instrumentation or surgery beyond the apex of the tooth	Prophylactic cleaning of teeth or implants where bleeding is not anticipated
Subgingival placement antibiotic fibres/stripes	Intracanal endodontic therapy, post placement crown buildup
Periodontal surgery, scaling, root planning, probing, recall and maintenance	Placement of rubber dams
Placement of dental implants	Post operative suture removal
Initial placement of orthodontic bands but not brackets	Placement of removable prosthodontic or orthodontic appliance
Reimplantation of avulsed tooth	Recording oral impressions
Intraligamentary local anesthetic injections	local anesthetic injections (non ligamentary)
	Orthodontic appliance adjustments
	Fluoride treatments
	Taking radiographs
	Shedding of primary teeth

**Table 5:** Recommended prophylactic coverage for Dental procedures of American Heart Association [46].

## Conclusion

With advances in cardiac care and cardiac surgery, many children are surviving to lead normal adult lives. A multidisciplinary approach while treating medically compromised dental patients is mandatory to reduce complications and to improve the prognosis. Patients with serious medical conditions may require modification in the manner in which dental care will be delivered or modifications in the dental treatment plan itself.

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