



## **Prosthetic dentistry in childhood**

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Prosthetic reconstruction is a part of a complex stomatological care in children and adolescents. It represents the 3rd part of prevention – tertiary prevention.

Prosthetic reconstruction in childhood differs by its specificity from the prosthetic reconstruction in adults especially by its limited time effect. The main requirement of prosthetic reconstruction in childhood is making the continuous development of orofacial system after the loss of a part of a dental crown or after the total loss of the tooth or teeth possible. The reconstruction in childhood has in addition to basic requirements that means the rehabilitation of function and phonation also some other important tasks: the reconstruction makes the completion of teeth development and deployment of development of alveolar processes in jaws possible. The prosthetic reconstruction has also a preventive orthodontic function either as space maintainer or stimulator. Esthetics and durability are in children relatively less important in comparison to adults. It is not possible to apply all rules that exist in adult prosthetics. One of main goals in adults are the longest vitality and durability of the reconstruction. The main goal in children is making the continuous development of orofacial system after the loss of a part of dental crown or the whole tooth /teeth possible. This goal gives to all prosthetic reconstructions in children the sense of temporary work.

Prosthetic reconstruction in childhood performs these basic functions:

Principles existing in adults as well:

1. rehabilitation of the function of biting and comminution of food
2. dental pulp protection
3. helps to correct phonation and articulation
4. esthetic function

Principles typical for childhood:

1. helps to the optimal teeth development and teeth eruption

2. supporting of dental arches growth
3. creation of the conditions for the right intermaxillary relations
4. supporting of dental bones growth
5. prevention of anomalies formations
6. supporting of the permanent teeth space
7. conditions creation for prosthetic reconstructions in the adult age

Specific functions of prosthetics reconstructions:

1. stopping of bleeding (topper plate)
2. filling of the hole (aperture) after the surgery intervention (obturator)
3. fixation of loosened teeth (injury, osteomyelitis, fixation teeth before planned resection of dental root)

### **Main principles of prosthetics in childhood**

In the prosthetics in children and adolescents especially the materials are used that are not toxic to the dental pulp, they do not create the immunity answer and do not irritate the soft tissues in the oral cavity. The reconstructions should be construct in the way to be easy changeable. They do not brake the development and the growth of given part of dental arches, the removable reconstructions may not compromise the buttress teeth and do not overload the mucosa and bone base of alveolar arches. The retention of removable dentures in children and adolescents may not use the wire clips because they could cause as a unintentional orthodontic appliance. The denture may not traumatise the marginal gingiva and interfere to the gingival sulcus. The regular checking of children with fixed or removable prosthetics is necessary. We check regularly the vitality of treated teeth in patient with fixed prosthetics reconstructions. Patients with removable reconstructions are called every three month and during the growth spurt and during the physiological exchange of teeth eventually even more often. Properly constructed removable reconstruction has the task not only to fill the gap after the lost teeth but it must ensure corret position of buttress teeth, save their biological value and ensure favorable conditions for a final solution in adult age.

### **Prosthetics reconstructions in primary dentition**

1. restoration of the crown of individual teeth – fixed reconstructions
2. restoration of whole parts of the oral cavity– removable reconstructions j.kuklová

All types of reconstructions must be constructed in such a way that they should be easy to change, it is necessary to choose such workflows where the pulp vitality will not be compromised. The saving of the pulp vitality and allowing of the spontaneous ending of tooth development are favored to perfect esthetics. The lost teeth must be replaced in such a way not to compromise the growth of given part of the alveolar bones as the buttress teeth can not be compromised.

## **Primary dentition**

### **Reconstruction of the crown in single teeth – fixed prosthetics**

The tooth crown can be affected by the loss of the tissue because of dental decay, injury or pathologic abrasion (dentinogenesis imperfecta, amelogenesis imperfecta). The lost tissue should be replaced as soon as possible. The developing teeth tend to a fast containment of the space that rises after the loss of the dental tissue. The antagonists or the neighbour teeth tend to move to this space. The circumstance conservation of the pulp vitality is also very important for the decision for using of a certain type of the prosthetic reconstruction.

In the primary dentition the injuries of the hard dental tissues are less common than the injuries of periodontal tissues. This situation corresponds with the relatively higher strength of the hard dental tissues in relation to the spongiosis in the alveolar processus. This situation exists especially in intact primary teeth. Another situation exists in children with the diagnosis ECC – early childhood caries. These children suffer from caries especially in the frontal part in the upper jaw. The caries destruction starts with the caries incipiens, that rapidly spreads into the cavitation. These small cavitations connect together and create a circular caries ring along the whole tooth cervix. The cutting edge in primary teeth in the upper jaw stays preserved, the strength of the tooth starts to be significantly reduced. This cutting edge will break after the fall or bite to a hard subject. The rest of the tooth is created by radix and the rest part of the crown from the cervix region, where the thin layer of enamel, softened caries dentin and opened pulp cavity can be seen. Thus affected teeth is not possible to treat endodontically for the age of the child, his /her possibility for cooperation and because of anatomic properties in primary dentition. The primary tooth after the loss of the whole crown cannot be reconstructed by the pin and crown – the root of the primary tooth goes under the physiological resorption and the pin would create an obstacle in the physiological process in permanent tooth teething.

Fixed reconstruction in primary dentition:

j.kuklová

## 1. protective crowns

The protection of the dental pulp in vital teeth and saving of the vitality are their main goals. The crowns restore the tooth shape, its biting possibilities and they prevent slope of the neighbour teeth to the gap that was created because of the dental tissue loss.

Types of the crowns in primary dentition:

- swaged crown made from gold-platinum material, today made by the lost wax method
- prefabricated shell crown
- prefabricated metal complete crown used for distal part in the oral cavity :
  - chromium-nickel
  - stainless steel

Fixation of the crowns: zinc phosphate cement (Adhesor), glass-ionomer cement for fixation of prosthetics reconstructions

Prefabricated crowns can be used in the case of the right size also for treating in the first permanent molars in handicapped patients. The minimal preparation of hard dental tissues and the treatment in one visit without the necessity to take the impression of the teeth are the preferences of these crowns. The crown can be adapted well, the favorable marginal integrity can be created and the crown is quickly to put on. The crown has highly smooth surface and it is very well accepted in the oral cavity because of good tactile sensation.

## 2. fixed space maintainers

They serve for conservation of the size of the gap formed after the premature loss of primary molars especially the loss of the second primary molars during the time of the first permanent molar teething. They may not be constructed like a fixed bridge. One branch must be free and bent to the peripheral tooth.

- orthodontic ringlet with wire or cast arc - this type can be used after the loss of the second primary molar after the first permanent molar erupted to the oral cavity. The orthodontic ringlet is fixed to the first permanent molar and after the impression the technician will create the arc that will touch the distal approximal surface of the first primary molar
- prefabricated stainless crown and wire or cast arc – after the premature loss of the first primary molar is the prefabricated stainless crown adapted to the second primary molar. After the impression the technician will create the arc that will be in contact with the distal approximal surface of the primary canine

J.Kuklová

### 3. fixed splints

They are indicated for fixation primary teeth after the injury or in osteomyelitis. They are made according to the imprint in the laboratory, fixed like the fixed prosthetic – with the help of zinc phosphate cement.

### **The reconstructions of the whole parts of the denture – the removable restorations**

The main task of these reconstructions is to complete the missed parts of the denture = single teeth or groups of more teeth, restore the function of the denture, make the right phonation possible and reconstruct the esthetics. These restorations fulfill also the preventive orthodontic function – they preserve the space in the dental arch, they impede the undesirable inclination or movement of the neighbour teeth or the antagonists. These restorations are described as the child removable restoration with the space maintainer function. In the case we want to accelerate the teething, the restoration is called the stimulator.

Removable restorations in primary dentition:

- may not brake growth and development of the alveolar processus
- may not obstruct teething of permanent teeth
- may not distress or block separate teeth
- may not cause the periodontal damage
- the restorations are created as the denture plates restorations

The causes of the premature loss of the primary teeth:

- injury
- extraction by reason of caries destruction and dental decay complication, ECC diagnosis

The premature extraction is each extraction in primary dentition that is carried out at the time, when the root development in the successor did not start yet. That consequently means the time when the period of intraalveolar teething did not start yet.

The removable restorations in the primary dentition:

- child removable restoration with the space maintainer function
- tongue shield, vestibular shield as a part of orthodontic treatment, especially bad ahabits

The removable restoration in the primary dentition can be done till the child is older than 3 years. Only at this time the primary teeth are full erupted and the child is able to accept the presence of the removable restoration in the oral cavity. In the case of the

j.kuklová

injury loss it is necessary to substitute 1-3 teeth in the frontal part of the upper jaw. In the case of caries destruction in the child with the ECC diagnosis the typical extensive primary teeth loss because of the necessary extractions is described: all incisors and the first molars in the upper jaw and first molars in the lower jaw. The teeth loss can be in some cases even more extensive.

In the case the child lost 1-2 primary frontal teeth because of an injury we make the impressions of both jaws to the alginate impression material and we must choose the colour of the teeth in the restoration. Usually we choose the very light colour according to the very light colour typical for primary dentition. The wax checkbite can be left out in the case with 1-2 lost teeth. The dental technician is able to arrange the upper and lower plaster model to the correct position. The restoration is made in the dental laboratory and in the second visit it is delivered to the patient.

In the case of an extensive loss in the primary dentition it is necessary to choose the same workflow as in the case of the total reconstruction. Impressions of both jaws to the alginate impression material are made in the first visit. The individual impression trays are creating in the dental laboratory. In the second visit the impression from zinc oxide-eugenol impression material is taken. Wax bite template for determine the jaw relationship that means height of the bite and central position of the mandibule is the programme in the third visit. In this visit the line of the smile and the middle line of the face is registered on the wax template and the colour of the restoration teeth is chosen. The removable restoration in the wax comes from dental laboratory to the dentist and is tested in the mouth. In the last visit the ready removable restoration is handed in to the patient.

According to the description it is seen that especially in the patients with the extensive loss of primary teeth the treatment is not easy and the cooperation of the small patients is necessary. The removable restorations in the primary dentition are constructed like as denture plates restorations. It is necessary to create the palate boarder of the removable restoration to the place between hard and soft palate also in the case of the lost of only one tooth. The retention of the denture is provided by the surface adhesion. In the vestibulum area the border of the denture is closed to the fornix vestibuli. The restoration must be designed without any clasps, only orthodontic Adams's clips can be used. The removable restorations in children have according to the growth dynamic a shorter-service life then in adults. This situation is accepted by the health insurance companies as well. The persistence of the removable restorations in adults is 3 years, in children this rule is not kept especially during the growth acceleration period.

J.kuklová

The removable restoration in the oral cavity is necessary to be regularly checked. The patients are called every 3 months. Approximately until the age of 5 years the removable restoration can serve to the patient without any changes because until this age the measurable changes in sagittal and transversal direction do not exist. At the time of starting teeth exchange it is necessary to smooth away the part that in the frontal area in the upper jaw clasps the processus alveolaris and at the place of first permanent molars it is necessary to remove the parts that cover the mucosa in the area of first permanent molars. The primary incisors as a rule will not be substituted after the 5<sup>th</sup> year and the first primary molars at the time when the bone is not present above the first premolar cusp. The space after the loss of second primary molar and primary canine should be preserved until the erupted tooth provides the space for itself.

### **The permanent dentition in children and adolescents – the mixed dentition**

The permanent teeth erupt to the oral cavity on the average after the 6<sup>th</sup> year. They are exposed to many exogenic affecting factors that can cause the dental crown destruction (injury, decay). Diagnosis of many development anomalies can be done only after the tooth eruption to the oral cavity. These anomalies represent not only an esthetic problem but also a functional problem and in the final consequence they can lead to the loss of a given tooth. Immediately after the eruption of the permanent tooth to the oral cavity this tooth can be described as a tooth with not completely finished development. The anatomic, histologic and biologic properties in the not completely developed teeth determine also the method of prosthetic in children and adolescents.

Prosthetic in children and adolescents is divided to three groups:

- fixed prosthetic reconstructions
- removable reconstructions
- splints

### **Reconstructions of the crown in single permanent teeth – fixed prosthetics**

The protection of the vitality, functional and esthetics rehabilitation are the main tasks in the fixed prosthetics. These demands come out into foreground especially in the not completely developed teeth. In these teeth the first-rate task is the ensurance of the physiological completing of the tooth development in the case of the treating method choice.

Prosthetic reconstruction must first protect the pulp and prevent the undesirable displacement of the antagonists. In young individuals the pulp cavity after the finished tooth development is relatively large and the secondary dentine layer is thin. That is why it is

j.kuklová

necessary in the fixed restoration indication for single teeth – crowns- to choose such methods that save the hard dental tissues and do not endanger the dental pulp and its vitality. The tooth tissue after its loss by every way must be on time reconstructed. The developing dentition especially in certain age periods and in some individual cases shows the tendency to close quickly the arised space after the lost dental tissue by the entrance of neighbour teeth or the antagonists to the free area. In this case the very difficult repaired defect and the articulating defect arise and the condition for future prosthetic treatment start to be worse.

The reason of the hard dental tissues loss:

- dental decay
- hard dental tissues injuries
- developmental anomalies: amelogenesis imperfecta, dentinogenesis imperfecta, Turner's tooth, MIH syndrom

In the case of a more extensive hard dental tissues loss it is necessary to evaluate:

- the distance between the dental pulp and the defect, the amount of the lost tissue and the course of the fracture line
- the dental pulp vitality and its reaction to the changed conditions
- the dental root developmental stage

The distance between the pulp and the defect line is given not only by the amount of the lost dental tissue, but also by the size of the pulp chamber in the coronal part of the tooth. Form this point of view also a relatively small loss of the tissue can be evaluated like the situation that is dangerous for the pulp vitality.

It is necessary to take the x-ray picture of given tooth before the therapy design. It is also necessary to reflect upon the possibility of cooperation of the child patient. The restoration by means of light-cuting material is possible in the case of smaller loss of the dental tissue and favourable course of the fracture line. The working technique is the same like as in adults.

Fixed restorations in children and adolescents – single permanent teeth:

- crowns
- pin restorations
- fixed space maintainers
- resin and composite veneers



Crown restorations of single permanent teeth are indicated in the case when the defect is so large that it is not possible to create the plastic material reconstruction without the risk of dental vitality loss and in the case with unfavourable course of the fracture line.

1. temporary protective celluloid crown – the teeth are treated with this crown immediately after the injury in the case the fracture line is situated in the neighbourhood of the dental pulp cavity in the uncomplicated fractures and after the pulp treatment in the case of complicated fracture ( that means the direct pulp capping, pulpotomia). These crowns are prefabricated in various sizes and it is necessary to adapt the crowns in the cervix region supragingival before their fixation to the tooth. The fractured surface is covered with the calcium hydroxyde material. These crowns are fixed during 4-6 weeks, the vitality of the tooth is checked and after this time period the tooth is treated by more stable and more durable crown. These temporary protective celluloid crowns are typical by their elasticity and that is why they have smaller strength and resistance. The material is thin and the crown can be easily placed to the interdental space. The children and the parents as well must be informed about this characteristic feature and about the necessary visit at the dentist in the case the crown is defect or loosened.

2. temporary protective polycarbonate crown – is prefabricated in one shade one colour and various sizes. It can be used when there is place enough between the neighbour teeth and antagonists.

3. jacket full cast crown– they are made with the help of lost wax method. The unfinished developed tooth is not fully erupted yet and that is why the crown border in the cervical part is situated supragingivally. The jacket metal crowns are indicated in the frontal teeth not very often, only in situations when the fracture line nears the pulp chamber and the essential part of the dental crown is lost. In these cases the fracture line is often horizontal near to the pulp. These crowns are indicated in the distal teeth in the case their extensive destruction by the dental caries and in the faulty development cases. According to the crown shape a defect shape it is not necessary in many cases to grind the tooth at all or we can use only separating strip in the interdental space. These crowns especially in the frontal part are not the final prosthetic work. More suitable esthetic crowns can be made after the completing of the root development and creating a sufficient thickness of the tertiary dentine. It is really necessary to check the vitality of the pulp very long because of the large loss of the hard dental tissues of the dental crown. In the case of the vitality loss the endodontic treatment starts immediately after this finding according to the developmental stage of the dental root.

When the endodontic treatment is finished the prosthetic restoration comes j.kuklová

and we make the crown in the nonvital tooth. The advantages of the jacket plate crown: minimal preparation, unadvantages: imperfect esthetics. These crowns are fixed with zinc phosphate cementum and the exposed place on the fracture line is covered with calcium hydroxate material.

4. Armature protective crown (modified open-face crown) can be done to the tooth with unfinished development. Their construction is created by the connection of metal part and resin veneer. The metal part embraces the tooth supragingival and in the interdental space has two projections in the so called bishop hat shape. This metal construction is completed with the thin resin veneer. The metal part was first created from plate, today it is casted by the lost wax method. The advantage: teeth are not brushed, the metal part is so thin that it goes into the interdental space. The nonadvantage: because the fractured tooth is not brushed, the crown is more thick in the vestibular direction and longer because of the resin veneer. The parents must be informed about these advantages and nonadvantages before the treating.
5. Resin jacket crown, composite jacket crown are indicated especially in nonvital teeth after the endodontic treatment. These crowns are brushed in the cervical part as the supragingival shoulder crown. In vital teeth they can be done after the 16<sup>th</sup> life year.
6. Shell crown, veneer crown with the gold as the metal basic part can be done as a treatment for nonvital teeth, after the pin reconstruction or in the age more than 16 lifeyear. It is necessary to brush the teeth and that limits the indications.
7. **Ceramic or metallo-ceramic crowns are not suitable for children and adolescents.** These materials are very hard, the oral cavity is in the development and the occlusion changes exist till the growth is finished. The antagonists to these crowns could be overloaded, the pathological abrasion could be present and the gingiva recession can start as the result in the oral cavity.

Pin reconstructions are indicated:

- in the cases with extensive destructions in the crown parts of the tooth when the tooth was treated by the pulp extirpation and the following endodontics treatment of the root channel
  - in the teeth with the deep vital pulp amputation, where the amputation course was lead on the boundary-line between the cervical and root pulp part, after the creating of the dentine bridge and after finishing of the root apexification

Two types of pin reconstructions can be used in the pediatric dentistry:

- pin reconstructions completed with the resin or shell gold crown
- pin reconstructions with moulded collar base

j.kuklová

In the pin reconstructions completed with the resin or gold shell crown we try to protect the dental tissues as much as possible, the enamel border in the cervix area is only slight brushed to the shape that follows up with the pin reconstruction. The pin extends only slightly over half of the root length, it has a cylindrical shape and cross section for the possibility to release it from the root channel in the case of the final solution in adults. The marginal seal is situated supragingivally. In the case the pin restorations is made from substitute alloys it it has not to come to the contact with the marginal gingiva. The pin restoration with moulded collar base is indicated in the teeth with wide root channel, thin root channel wall and in the fractures where the fracture line is situated subgingivally. In the cases where the pin and the moulded base touch the marginal gingiva these reconstructions are made from dental precious metal. The pin reconstructions with moulded collar base represent the definitive solution because it is very difficult to remove them.

Principles for creating of the pin reconstructions in childhood:

- the root channel entrance may not be unnecessary extended
- the retention into the root channel makes the potential taking out of the pin possible
- the pin does not engage the whole root lumen in the wide channels
- the length takes only till the half of the root

Fixed space maintainers

**Rochet's splint** are made from gold or substitute alloys. They are indicated for treating of small spaces in the frontal area. The preparation is not necessary. They are fixed from the oral site with the help of self-curing resin (Spofacryl) or the materials used for fixation of orthodontic brackets. The Rochet's splint does not reach to the marginal gingiva. On each site it is extended to 2 teeth and that is why the fixating effect is present as well. The Rochet's splint can be made only in teeth with finished development after the growth in given reason is finished. The Rochet's splint can not be done in patients with high caries frequency and in the case of poor oral hygiene. They can be done only in the cases when the teeth in given range took the final position and when the orthodontic therapy will not come true in the future. The Rochet's splint need regularly checking together with the checking of the oral hygiene and dental caries situation.

**The Maryland bridge** is the variety for the distal part in the oral cavity. The retention is provided by the retentive arms on the lingual and vestibular surfaces of the teeth on the space sides. The same indication limit is valid here as in the Rochet's splint. J.kuklová

The teeth after etching and bonding of the fixed space maintainers are necessary to be treated by the fluoride materials application.

**Resin veneers** are indicated in the case of damage of the vestibular surface in the frontal teeth. The minimal preparation is necessary, they are fixed with the glass ionomer cements that are used for prosthetic products fixation.

### **Children's denture of the whole parts of the teeth – removable prosthetics**

The removable restorations of the permanent teeth in children and adolescents are indicated:

- loss of teeth due to accident, dental decay
- developmental anomalies of teeth number = hypodontia, oligodontia or anodontia

Hypodontia means the teeth of only one teeth group are missing. In the permanent dentition this developmental anomaly is more often than in primary dentition. The upper second incisors and second premolars in both jaws are the most often missing teeth. In the lower jaw the central incisors can miss as well, but not so often as the second incisors in the upper jaw. Oligodontia means that teeth from more than one teeth group are missing. Anodontia means that no permanent tooth is present in the oral cavity and only primary teeth are present. This type of anomaly is very rare.

The main task of the removable reconstructions is saving of the space for the final reconstruction of dental arches in adult age together with the prevention of the slope of adjacent teeth into the gap in dental arch and they prevent the shift of antagonists into the gap. Another important task is the functional rehabilitation of dentition and restoration of the proper phonation and esthetics. The cooperation with the orthodontics is very important. These restorations can be combined with the orthodontic appliances, in some cases the orthodontic treatment must be done first. In common there is a rule that the space for the permanent tooth is saved only in cases where it is not possible to close the space by the movement of the neighbour teeth. The goal is to hold the right inclination of the teeth axis that will be suitable for the later prosthetic treatment in the adult age. In some cases the removable restoration is the final treatment possibility that will be replaced by the removable restoration with the dento-mucous respectively dental transmission of masticatory forces. The possibilities are:

- plates with the maximum range of compensation for the gingival transfer of masticatory pressure in such manner not to arise the pressure bone atrophy
- it is possible to use only the Adam's clasps
- these removable reconstructions can be combined with the

j.kuklová

## orthodontic appliances

It is necessary to check regularly these removable restorations and in time make a new one if it is necessary. Unadvantages of removable restorations: deterioration of the hygienic situation in the oral cavity at the age when the high caries incidence is very often. In the case the removable restorations are not correctly done they can endanger the periodontal tissues especially in teeth in the space neighbourhood. The removable restorations can be the source of the mucosa denture supporting area changes. These changes are called stomatitis prothetica. The resin used for removable denture creating can call the mucosa allergy reactions. That is why we must try to use these restorations to as short period as possible. In the cases when the fixed space maintainers can be used we use this ones.

Fixed splints are indicated for fixation of teeth loosened after the injury or due to a pathologic process in the right position. Their task is to give the area necessary quiet for healing processes. They are done according to the impressions in the dental laboratory and their range includes the whole dental arch. They are fixed for the given indication time with the zinc phosphate cementum.

In the case of dental injury of periodontal ligaments today we prefer the fixation with help of the photocomposite material and orthodontic wire (lesson: injuries and their treatment).

The plates determined for stopping of bleeding are engaged in a specific problem. The plate is called Kilian's plate according to professor Kilian from Pilsen University. The basic significance for stopping of bleeding belongs to the local treatment and to the qualified total cure. The substitutive therapy and other medicine cure depend on the diagnosis of the basic illness. Local measures are important especially in the hemophilia illness. Local measures are the wound compression and the application of the cover plates made from resin. They are made before the planned extractions in the dental laboratory according to the alginate impression. This plate must cover the wound widely and develop a pressure to it. The Kilian's plate covers all teeth and the neighbour mucosa of the alveolar process and the palate in the upper jaw. In the extraction wound place the plate is maximally extended into to vestibulum and there are no clasps in the plate. It is fixed immediately after the extraction by the help of a thin layer of zinc oxide-eugenol paste (Repin). The children with haematological diseases must be treated during their stay in the hospital and they need a special haematologic adjustment by the haematologist before the extraction or another surgery treatment.

The postoperative palatal plates are the modifications of the Kilian's plate. They protect the operation wound on the palate and make their healing more quickly possible. They cover the

whole palate and they are fixed with the help of wire clamps to the teeth. They are fixed with the help of the zinc oxide-eugenol paste as well (modification according to Kilian).

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