Oral Health: It’s Not Just a Cavity

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The Primary Dentition

• The primary dentition consists of twenty teeth.
• There are four incisors in each arch, two canines, and four molars.
• The primary dentition begins formation at fourteen week in utero.
• Enamel formation is complete on all primary teeth by 12 months of life.
• The primary teeth begin their eruption in the mouth of the infant at an average age of 6 months, and are completely erupted (on average) at 24 months.
• The primary dentition is in complete occlusion by age three.

The Primary Dentition

• Mandibular Central Incisor: 6 Months
• Mandibular Lateral Incisor: 7 Months
• Maxillary Central Incisor: 7½ Months
• Maxillary Lateral Incisor: 9 Months
• Mandibular First Molar: 12 Months
• Maxillary First Molar: 14 Months
• Mandibular Canine: 16 Months
• Maxillary Canine: 18 Months
• Mandibular Second Molar: 20 Months
• Maxillary Second Molar: 24 Months

Agenda

Introduction
Infant Oral Health
Lesions in the oral cavity of the newborn
Q&A

Eruption schedule and sequence
Caries is a biofilm (plaque)-induced acid demineralization of enamel or dentin, mediated by saliva.

The disease of early childhood caries (ECC) is the presence of 1 or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger.

In children younger than 3 years of age, any sign of smooth-surface caries is indicative of severe early childhood caries (S-ECC).

The CDC reports that caries is the MOST prevalent infectious disease in our nation’s children. More than 40% of children have caries by the time they reach kindergarten.

In contrast to declining prevalence of dental caries in older age groups, the prevalence of caries in poor US children under the age of 5 is increasing.

Early childhood caries (ECC) and the more severe form (S-ECC) can be particularly virulent forms of caries, beginning soon after eruption, developing on smooth surfaces and progressing rapidly.

Caries affects the general population but is 32 times more likely to occur in infants who are of low SES, who consume a diet high in sugar, and whose mothers have a low education level.

Caries in primary teeth → affect children growth
Caries in primary teeth → significant pain → potentially life threatening
Caries in primary teeth → decrease in quality of life

Medical health care professionals are far more likely to see new mothers and infants than are dentists. It is essential that they be aware of the infectious etiology and associated risk factors of ECC to make appropriate decisions regarding timely and effective interventions.

Cost comparison of two chronic childhood diseases:

**Asthma**

- One in 12 people (about 25 million, or 8% of the population) had asthma in 2015, compared with 1 in 14 (about 20 million, or 7%) in 2001.
- Medical expenses associated with asthma were $57.1 billion in 2017.
- On average, in 2017 children missed 4 days of school and adults missed 5 days of work because of asthma.

**Dental Caries**

- Dental caries affects more than 25% of U.S. children aged 2–5 years and half of those aged 12–15 years. Among 5- to 17-year-olds, dental caries is more than 5 times as common as a reported history of asthma.
- In 2015, an estimated $108 billion was spent on dental services in the United States.
- Approximately 13,675,100 million school hours were missed annually by school-aged children due to a dental problem or visit, with 117 hours missed per 100 children.
Transmission

- Vertical
- Parent to child
- Horizontal
- Non-parent transfer
- Between spouses
- The most common vehicle is saliva
- Window of infectivity
  - From 19 to 30 months of age
  - Has been found in children as young as 10 months
  - One study found Streptococcus mutans in 53% of 6 to 12 months children

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Etiological Factors in Dental Caries

1) Microorganisms—some oral flora are cariogenic, others protective
2) Host factors (saliva, tooth anatomy, oral hygiene, etc)
3) Substrate (fermentable carbohydrates)
4) TIME: the more often the above factors are in contact, the more damaging the effect.

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Etiology of Caries—The Disease: WHAT WE ONCE BELIEVED

3 Major Hypotheses:
1) Specific Plaque Hypothesis—proposes that only certain species of bacteria are involved in the caries process.
2) Nonspecific Plaque Hypothesis—assumes all plaque/bacteria is pathogenic.
3) Ecological Plaque Hypothesis—suggests that shifts in the pH of the biofilm cause a shift toward cariogenic bacteria (Streptococci mutans) in the balance of resident oral flora, resulting in disease.

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In epidemiology, a confounding variable is an outside factor that correlates (positively or negatively) with the independent variable and the dependent variable.

So why do some people develop carious lesions while others don’t despite having similar oral environments?

CONFOUNDERS: Found along the periphery of the circle, these are factors that help describe variations in risk status between individuals with similar determinants (inner circle). Confounders include education, socioeconomic status, knowledge, attitudes, and behavior.

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Ecological plaque hypothesis


Dental caries

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Etiology of Caries: The Lesion

ENAMEL is composed of:
95% hydroxyapatite (HA): Ca_{10}(PO_4)_6(OH)_2
4.5% water
0.5% organic matrix (proteins—amelogenins, enamelines)

Various ions (such as fluoride) can be incorporated into the HA crystals.

Demineralization of enamel: under neutral conditions, a dynamic equilibrium exists between the mineral content of enamel and the oral fluid. However, when the oral environment is acidic, the H+ ions in the oral fluid react with the phosphate ions and hydroxyl ions in the enamel. The oral fluid is now unsaturated with phosphate ions, so these ions are leached from the enamel in an effort to reestablish equilibrium.

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Etiology of Caries: The Lesion

When demineralization exceeds remineralization, a carious lesion forms.


Fluoride and Remineralization

Although fluoride has multiple cariostatic mechanisms, remineralization is thought to be the primary one. Fluoride enhances remineralization by serving as a nucleation enhancer for new mineral deposition.

However, fluoride-enhanced remineralization is dependent on the availability of phosphate and calcium ions. In vitro studies have shown that when these 3 ions are present together, that remineralization of lesions penetrating dentin can be obtained. Fluoride alone results in mostly surface remineralization.

Saliva is critical for remineralization as it both acts as a vehicle to transport fluoride ions into the demineralized enamel and acts as a reservoir for calcium and phosphate ions.


Caries-risk assessment for infants allows for the institution of appropriate strategies as the primary dentition begins to erupt.

Screening for caries risk in the parent and infant, coupled with oral health counseling is critical.

Early establishment of a dental home, including ECC prevention and management is the ideal approach for infant oral health (at what age?)

Recommendations for parental oral health
- Dietary education for the parents
- Role of the frequency of consumption
- Fluoridated toothpaste
- Rinsing with an alcohol-free mouth rinse
- Evidence suggests the use of xylitol chewing gum (2-3 times a day by the mom) has a significant impact on mother-child transmission of MS.

Infant Oral Health

RECOMMENDATIONS

Oral health education → etiology and prevention of ECC
Avoiding saliva-sharing behaviors
Oral examination and treatment during pregnancy
Professional oral health care
Brushing with fluoridated toothpaste
Infant Oral Health

RECOMMENDATIONS

- Oral health risk assessment (primary health care provider)
- Establishment of a dental home (by 12 months of age)
- Teething (if necessary → oral analgesics and chilled rings)
- Oral hygiene (no later than the eruption of the first primary tooth, performed by a parent, twice daily, using a soft toothbrush of age-appropriate size and the correct amount of fluoride toothpaste)

Diet

- Human breast milk (uniquely superior in providing the BEST possible nutrition to infants → NO associated with CARIES → However “ad libitum” breast-feeding and more than 7 times daily after 12 months of age
- Nightly time bottle feeding
- Use of sippy cup
- Frequent and in between meals consumption of sugar-containing snacks or drinks

Fluoride

- Optimal exposure is CRITICAL
- Correct amount of fluoride twice daily
- Professionally-applied topical fluoride
- Systemically-administered fluoride (less than 0.6 ppm)
- Injury prevention
- Non-nutritive habits

SILVER DIAMINE FLUORIDE: NEW AAPD GUIDELINE

- INSTITUTE OF MEDICINE OF THE NATIONAL ACADEMIES

  • U.S. Congress, through the Medicare Improvements for Patients and Providers Act of 2008, asked the IOM to undertake a study on the best methods used in developing clinical practice guidelines.

ADA CLINICAL PRACTICE GUIDELINES

- Non surgical treatment of chronic periodontitis
- Prosthetic Joint
- Topical fluoride
- Fluoride supplementation
- Fluoride toothpaste
- Non-fluoride caries prevention
- Pit and fissure sealants
COMMERCIAL AVAILABLE AG SALTS FOR CARIES MANAGEMENT

- Two Ag salt products are currently available in the USA for caries management.
  - Silver Nitrate solution (25%)
  - Silver Diamine Fluoride Solution (38%)

38% SILVER DIAMINE FLUORIDE SOLUTION

- Became commercially in United States - March 2015
- FDA clearance - Class II medical device tooth hypersensitivity
- Not recommended for use in people under the age of 21

SILVER DIAMINE FLUORIDE

38% Silver Diamine Fluoride (Ag(NH₃)₂F) –
  - Clear solution
  - pH ~8 to 10
  - Metallic taste

CARIES MANAGEMENT CHALLENGES

- Very young children
- Elderly
- Medically compromised
- Uncooperative patients
  - Age
  - Cognitive status

MANAGING EARLY CHILDHOOD CARIES

- No recognized standard of care.
- Surgical approaches often involve costly restorative treatment with sedation or GA.

Baby Dies Under Anesthesia as Dentist Fixed Cavities
Inside Edition
August 30, 2016
SILVER SALTS

- The silver ion has strong antimicrobial activity.
- Consequently silver is used in products from water line management to home cleaning clothes.

SILVER NITRATE

- AgNO₃
- Least expensive salt of silver
- Commercially available in a variety of concentrations
- Has been used for over 1000 years in various medical applications

Silver Compounds

<table>
<thead>
<tr>
<th>Period</th>
<th>Advances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1900</td>
<td>AgNO₃ used in dental management</td>
</tr>
<tr>
<td>1917</td>
<td>Nover’s solution (AgNO₃:H₂O) invented and used up to 1950s</td>
</tr>
<tr>
<td>1970s-1980s</td>
<td>AgF used alone and combined with SrF₂ in clinical studies in Western Australia</td>
</tr>
<tr>
<td>1970s</td>
<td>Development of SDF in Japan supported by Central Pharmaceutical Council of the Ministry of Health and Welfare</td>
</tr>
<tr>
<td>1990s</td>
<td>SDF was recommended for young children in Brazil</td>
</tr>
<tr>
<td>2000s</td>
<td>Randomized controlled clinical trials on SDF and other preventive treatments</td>
</tr>
</tbody>
</table>

Peng et al., 2012

SCOPE AND PURPOSE

- Inform clinical practices involving SDF application to enhance dental caries management outcomes
- Primary outcomes of interest: caries arrest

REMAINING QUESTIONS??

- Optimal protocol for application
- Reapplication rate
- Caries prevention vs arrest
- Long term affect on microbiome
- Cost savings
- Need for clinical guidance

Table 1 - Use of silver compounds for caries management in dentistry.

<table>
<thead>
<tr>
<th>Period</th>
<th>Advances</th>
</tr>
</thead>
<tbody>
<tr>
<td>1927</td>
<td>SDF reduces bacteria from 10² to 10⁵ folds (10:1) lower than 10⁻⁵</td>
</tr>
<tr>
<td>1940s</td>
<td>SDF reduced in plaque microbiota</td>
</tr>
<tr>
<td>1950s</td>
<td>SDF reduces bacteria from 10⁻³ to 10⁻⁷ folds (10²:1) lower than 10⁻⁷</td>
</tr>
<tr>
<td>1960s</td>
<td>SDF reduces bacteria from 10⁻⁵ to 10⁻⁷ folds (10²:1) lower than 10⁻⁷</td>
</tr>
<tr>
<td>1970s</td>
<td>SDF reduces bacteria from 10⁻⁷ to 10⁻⁹ folds (10²:1) lower than 10⁻⁹</td>
</tr>
<tr>
<td>1980s</td>
<td>SDF reduces bacteria from 10⁻⁹ to 10⁻¹¹ folds (10²:1) lower than 10⁻¹¹</td>
</tr>
<tr>
<td>1990s</td>
<td>SDF reduces bacteria from 10⁻¹¹ to 10⁻¹³ folds (10²:1) lower than 10⁻¹³</td>
</tr>
</tbody>
</table>

Peng et al., 2012
Does the application of SDF arrest cavitated caries lesions as effectively as other treatment modalities in primary teeth?

SAFETY - SHORT TERM SDF SERUM PHARMACOKINETICS
- Mean DSF solution applied to the 3 teeth was 7.57 mg (6.04 μL)
- 4 hour observation period,
- Mean max serum concentrations: F = 1.86 μmol/L; Ag = 206 nmol/L
- F and Ag EPA oral reference dose - cumulative daily exposure over a lifetime

SILVER DIAMINE FLUORIDE POSSIBLE ADVANTAGES
- Control of pain (it’s noninvasive)
- Control of infection (inherent in the material)
- Ease of use
- Affordability of material (it costs just pennies per application)
- Minimal time for application

CASE SELECTION IS CRITICAL
- Caries control approach: enamel – dentin caries that is not encroaching on pulp or associated with spontaneous pain.
- Parents/Patient consent
- Parents/patient are OK with tooth staining.

GOALS OF TREATMENT
- Arrest caries process.
- Prevent/delay surgical treatment with sedation or with GA.
- Stop caries progression and pulpal demise.
- Subsequent restoration - consider need to replace form, function, esthetics.

CLINICAL APPLICATION OF SILVER DIAMINE FLUORIDE
- Wear gloves - avoid tissue tattoos from SDF.
- Paper tray cover to protect counter surfaces before dispensing one drop of SDF solution.
**Silver Diamine Fluoride Protocol**

- Isolate the tooth with cotton rolls or other means.
- Moisten carious lesion with smallest amount of SDF solution possible with a microbrush.
- Be careful not to touch intra or extraroral soft tissues with microbrush or solution.

**Follow Up Treatment Alternatives**

- Leave teeth unrestored until child is older.
- Consider restoration.
- GI restoration or Atraumatic Restoration Technique.
- Resin strip crown with minimal removal or black areas of caries.
- Minimal reduction on posterior with SSC (modified Hall technique).

**Take Home Message**

- Evidence is not complete, some good quality studies.
- Mechanical caries removal not necessary.
- Biannual application better than annually (70% arrest with one treatment ~ 90% with two treatments).
- SDF is part of comprehensive caries management program but—there is no silver bullet.

**Soft Tissue Pathology in Infants and Toddlers**

- Image from Microsoft Clip Art

**Oral Cavity Conditions**

- 10,032 US Children and youths aged between 2 and 17 years.

Oral Cavity Conditions

10,032 US Children and youths aged between 2 and 17 years

Distribution by age

Recurrent herpes labialis

Geographic tongue

Cheek/lip bite

The Diagnostic Challenge in the Pediatric Patient

History

Chief complaint
Parents "version"
Child "version" (if any...)
Past medical history
Behavior
Behavior

Common oral lesions in the infant

1. Palatal and Gingival Cysts of the Newborn
2. Melanotic Neuroectodermal Tumor of Infancy
3. Congenital Epulis of the Newborn
4. Natal teeth
5. Vascular malformation

Epithelial lined cavities
Most often found along the median palatal raphe and/or the junction of the hard and soft palate
Very common, have been reported in 65% to 85% of neonates
Usually multiple and small (1-3 mm)
Historically named based on location
Epstein's pearls
Bohn's Nodules
Collectively known as palatal cysts of the newborn
Epstein’s Pearls

Though to arise from small islands of epithelium that become entrapped during the fusion of the palatal shelves.
The most common place is the palatal midline

Bohn’s Nodules

Thought to arise from the epithelial remnants derived from the development of the minor salivary glands of the palate.
The most common place is the buccal or lingual surface of the alveolar ridge (not the crest) or in the hard palate away from the midline

Palatal Cyst of the Newborn

Treatment and Prognosis:
- No treatment required
- Self healing
- Thought to rupture onto the mucosal surface and eliminate keratin contents.

Melanotic Neuroectodermal Tumor of Infancy

Relatively uncommon osteolytic – pigmented neoplasm

Primarily affects the jaws of newborn infants

It is locally aggressive, benign lesion of neural crest origin that occurs exclusively in infants younger than 1 year of age

Most common place → anterior maxilla

High recurrence rate

High urinary excretion of vanillyl-mandelic-acid

Gingival cyst of the newborn

- Also known as Dental Lamina Cysts
- Small keratin filled cysts found on the crest of the alveolar mucosa of infants
- Common, seen in up to 50% of all newborns.
- Small, usually multiple (usually no more than 2-3 mm)
- Maxillary alveolus more commonly involved than mandibular
- No treatment is indicated

Congenital epulis of the newborn

- First described by Neumann in 1871
- 9:1 female-to-male ratio
- Affects the maxilla 3x more than mandible
- Most frequently occurs lateral to midline in developing lateral/canine area
- Epulis is derived from the Greek word meaning “on the gum” or “gum boil”
- Multiple tumors develop in 10% of cases
Congenital epulis of the newborn

• Treatment

• Usually treated by surgical excision.

• Lesion has never been reported to recur, even with incomplete removal.

• After birth, the tumor appears to stop growing and may even diminish in size.

• Complete regression has been reported even without treatment.

Congenital epulis of the newborn


Premature eruption

• Natal Teeth: Erupted deciduous teeth present at birth

• Neonatal Teeth: Deciduous teeth that erupt during the first 30 days of life

Premature eruption

• Etiology unknown; possibly related to superior position of the tooth germ

• Prevalence estimates (1:2000-1:6,000)

• Familial pattern sometimes observed

• Usually found in otherwise normal infants

• No conclusive evidence of a correlation with systemic syndromes/conditions, but has been suggested.

Premature eruption

• Treatment:

• make a radiograph

• if tooth/teeth excessively mobile, may consider extraction (avoid extraction before 10 days old, assess the need to administer Vitamin K beforehand to prevent hemorrhage)

• if incisal edge sharp and causing ventral tongue lacerations (Riga-Fede disease), may consider smoothening edge, covering with resin, or extraction

• if possible, leave the tooth in place (consider additional Fluoride applications)

Premature eruption

• Usually involves only 1 or 2 teeth

• 85% are mandibular primary incisors

• Most commonly involves primary mandibular centrals

• Commonly occurs in pairs

• Natal and neonatal molars are very rare (only 20 reported cases since 1897)

• Are rarely supernumerary teeth (only 5%)

• Are frequently hypermobile

• May be opaque yellow-brownish in color

• May cause difficulty for breast-feeding mothers

Vascular tumors

Vascular malformations
Hemangioma
Infantile hemangiomas are the most common tumors of infancy. Beginning in the first 2 weeks of life with a proliferative phase, dominated by the replication of endothelial cells. The phase is usually for one year. Over the next 7 to 10 years (involution phase), proliferation is reduced. Many lesions will not require any corrective surgery. About 20% of the lesions are disfiguring and can destroy the normal tissue and compromise the life of the baby. The specific etiology of the hemangiomas remains unclear. Most hemangiomas are sporadic, solitary, and well localized. Close to 80% of the hemangiomas are localized in the head and neck regions. Most hemangiomas are relatively small and don't have significant clinical problems.

Vascular tumors
Approximately 20% become significant and require surgical treatment. Complications associated with hemangiomas include ulceration, hemorrhage, infection, and in some cases high cardiac output. Apart of the 2 extremes of clinical management (waiting for involution or surgical excision), complications or parental concern may indicate treatment. The treatment objective is inducing or accelerating the natural involution of these lesions. The most widely used option is systemic steroids or local injection of steroids with a reasonable success rate. The perfect time to provide treatment is during the proliferative phase.

Congenital vascular malformations
Pain can be present but the majority of cases are asymptomatic. Vascular malformations grow in size, they may grow suddenly after trauma or infection. Lesions are usually soft, compressible and non-pulsatile. Doppler ultrasound and MRI are generally the preferred methods for an adequate and complete assessment and follow up. The treatment for small, asymptomatic lesions is conservative. For more extensive lesions the treatment include sclerotherapy or surgical resection.

Most Common ulcers caused by virus in the oral cavity of toddlers
Most Common Viral Infections of The Oral Cavity
RNA → Coxsackievirus group A
DNA → Herpes Simplex Virus
Human Papilloma Virus
Most Common Viral Infections of The Oral Cavity

RNA → Coxsackievirus group A

Herpangina
Acute lymphonodular pharyngitis
Hand-foot-and-mouth disease

Herpangina Oral ulcerations limited to the soft palate, uvula, tonsils, and fauces.
Incidence of the disease peaks during the initial months of summer and fall.
Sudden fever, sore throat, headache, dysphagia, and malaise followed in 24 to 48 hours by erythema and vesicular eruption.

Viral Infections

DNA → Herpes virus
Human Papilloma Virus

Oral Herpetic Infections

• Herpes virus cause a primary infection when the patient initially contacts the virus and then remain latent within the nuclei of specific cells for the life of the individual.
• HSV 1, and VZV remain latent in sensory nerve ganglia.
Oral Herpetic Infections

• After reactivation, HV can cause localized symptomatic or asymptomatic recurrent infections.
• They are transmitted from host to host by direct contact with saliva or genital secretions.

Primary herpes virus infections
• The incidence of primary infections with HSV-1 increases after 6 months.
• The incidence reaches a peak between 2 and 3 years of age.
• A significant percentage of primary herpes infections are subclinical or cause pharyngitis difficult to distinguish from URI.
• Significant prodromal with generalized marginal gingivitis.
• Primary HSV in healthy children is usually self-limiting disease.
• Treatment: palliative Antiviral ?

Recurrent herpes simplex infections
• Several studies have been published comparing topical antiviral medications for treating RHV
• Topical penciclovir (Denavir®) and topical acyclovir (Zovirax ®) reduce the duration and pain of RHV by 1 or 2 days.
• N-docosanol (Abreva®) is a topical cream ONLY OTC approved by the FDA
• Other topical products: L-lysine
• Systemic treatment: Acyclovir, valacyclovir and famcyclovir

Systemic Antiviral Therapy:
Rx: Zovirax or generic (acyclovir) 200 mg/5 mL suspension (children)
Disp: Appropriate mL
Sig: Take appropriate mL every 4 hours or 5 times a day for 7 days.

Pediatric significance: It is not FDA-approved for this use. Limited pediatric studies have shown that systemic acyclovir may be beneficial in treating primary herpetic gingivostomatitis (see Cochran Review). The dosage for mucocutaneous herpes simplex viral infection in this age group is 15 mg/kg (maximum dose 200 mg), five times a day or 1000 mg/day PO in 3–5 divided doses for 7-10 days or until clinical resolution occurs. Maximum dosage is 80 mg/kg/day. Systemic antiviral therapy is usually reserved for children with moderate to severe primary orolabial infections because therapy results in shortened duration of symptoms and viral shedding.

Rx: Zovirax or generics (acyclovir) capsules 400 mg (adolescents)
Disp: 21-30 capsules
Sig: Take 1 capsule 3 times daily for 7-10 days.

Pediatric significance: It is not FDA-approved for this use. Systemic antiviral therapy is usually reserved for children with moderate to severe primary orolabial infections because therapy results in shortened duration of symptoms and viral shedding. Alternative dosing includes 800 mg PO every 8 hours for 7-10 days. (CDC recommendations)

Rx: Valtrex or generics (valacyclovir) caplets 1 g (adolescents)
Disp: 14-20 caplets
Sig: Take 1 caplet BID for 7-10 days.

Differential diagnosis:
RAS (NO prodromal symptoms and NO gingivitis)
Coxackie viral infections (hand-foot and mouth – herpangina)
Erythema multiforme

Laboratory testing: It may be necessary to diagnose atypical presentations.
Gold standard → tissue culture
Cytology smears → Tzanck smear
Immunology test → (DFA)
Human papillomavirus infection of the oral mucosa

Classification

- Papillomaviruses are small, double stranded DNA viruses.
- Human can be infected only by HPV's, not by papillomaviruses found in animals.
- The HPV genome contains eight open reading frames (ORFs) which are potentially coding sites of six early proteins (E) and two late proteins (L). The L1 ORF is used to identify the different types of HPV because it is the most conserved of the eight ORFs within the genome. (1)

1. Rautava J, Syrjanen S. Human papillomaviruses infections in the oral mucosa. JADA 2011; 142(8):905-914

Human papillomavirus infections of the oral mucosa

Classification

- Investigators have described more than 120 different HPV types on the basis of the isolation and sequencing of complete genomes. (1)
- Most HPV that infect oral mucosa site belong to the alpha papillomaviruses, which consist of 15 species. (2)
- To date, investigators have identified 30 HPV genotypes: 15 high-risk types, 3 types that probably are high risk and 12 low-risk types.


Acquisition of oral HPV infection

- HPV infections are transmitted mostly by means of close contact.
- Infectious HPV spreads especially through sexual contact but also vertical (cervical canal during the delivery) and through autoinoculation. (1)
- Investigators detected HPV in placental (4.5%) and cord blood samples (3.5%), both of which indicate an increased risk among newborns of becoming carriers of oral HPV at birth. (2)
- Horizontal transmission among family members also is possible in childhood, and in that the role of the mother seems to be more important than the father. (3)
Human papillomavirus infections of the oral mucosa

Acquisition of oral HPV infection

• A mother's persistent HPV infection might increase the infant's risk of developing oral HPV (OR=5.7; 95% CI). (1)

• Oral sex has been speculated to be the main transmission mode of HPV infection. However, follow-up studies are lacking, and most of the data are derived from studies of head and neck SCC in which the risk factors have assessed at a general level. (2)

• In a cohort study of spouses, oral sex was not associated with oral asymptomatic HPV infection. Instead, persistent HPV infection in one spouse was a significant factor (OR=4.3; 95% CI, P=0.06) for persistent oral HPV infection in the other spouse. (3)

2. D'souza G et al. Oral sexual behavior associated with the prevalence of HPV infection. Journal of Infectious Disease 2009

Viral life cycle

• After cell division, the infected daughter cells migrate towards the suprabasal region and begin to differentiate, which triggers a coordinate transcriptional cascade of the viral genome. (1)

• Viral proteins (E6 and E7) retard the normal terminal differentiation by stimulating cellular proliferation and DNA synthesis through interfering with and inhibiting several cell cycle-regulators to allow amplification of the viral genome. (3)

2. Image from Google open access images

HPV and oral conditions: asymptomatic oral mucosa

• Low risk HPV genotypes are often responsible for benign oral mucosal lesions such as ordinary warts, condylomas, focal epithelial hyperplasia and oral papillomas.

• The most common low-risk genotypes are HPV-6 and HPV-11. The skin types HPV-2 and HPV-4 have been found also in oral lesions. (1)

• Both girls and boys with HIV are at increased risk of developing genital and anal HPV, also HPV lesions in the oral cavity are more frequent. (3)

• Interestingly enough, during the anti-retroviral treatment of HIV, the occurrence of many HIV-associated disease decline dramatically, EXCEPT HPV associated lesions. (2)

(immune response is not a major determinant in the development of HPV)

HPV and oral conditions: benign lesions

• Squamous Papilloma
• Verruca Vulgaris (common wart)
• Condyloma Acuminatum
• Multifocal Epithelial Hyperplasia (Heck Disease)
Squamous papilloma
- Benign proliferation of stratified squamous epithelium
- The lesion is induced by HPV
- Exact mode of transmission is unknown
- Equal frequency in boys and girls
- More common places: tongue, lips, and soft palate.
- The papilloma is usually solitary
- Histopathology: proliferation of keratinized stratified squamous epithelium in “finger like projections” with fibro-vascular connective tissue cores.

Verruca Vulgaris
- It is a benign, virus-induced focal hyperplasia of the stratified epithelium
- HPV is found in almost all the lesions
- Frequent lesion in children
- Hands is usually the site of the infection. Oral cavity: anterior tongue - lips

Condyloma Acuminatum
Condyloma acuminatum is a STD appearing most frequently as a soft, pink cauliflower like growth.
The condition is highly contagious
Both genders are affected equally
The peak incidence is between 17 to 20
The histology shows \[\text{papillary lesions}\]