Orthodontic Treatment for Patients with a History of Cancer

2018 AAO / AAPD Joint Winter Conference
Barbara Sheller DDS, MSD
February 9, 2018

Overview
- Pediatric cancer
- Statistics
- Cancer warning signs in children and adolescents
- Long term effects of cancer treatment
- Craniofacial and dental effects of cancer treatment
- Patient scenarios

20% die within 5 years of diagnosis

Leading causes of death between ages 1 - 19 years in US
1. Accidents
2. Homicides
3. Suicides
4. Cancer
∞ Most frequent disease-related death

Differences Between Pediatric and Adult Cancers
- Not strongly linked to lifestyle
- Occur in different parts of body
- More aggressive and rapidly growing
- No effective screening test
- Early detection may not influence outcome or alter treatment
- Respond more readily to chemotherapy and radiation

Most Common Malignancies in Infants, Children, and Adolescents in USA (2000-2011 National Cancer Institute Surveillance, Epidemiology, End Results Program)

<table>
<thead>
<tr>
<th>Cancer Type</th>
<th>All Pediatric Ages</th>
<th>&lt; 1 year</th>
<th>1 to 4 years</th>
<th>5 to 9 years</th>
<th>10 to 14 years</th>
<th>15 to 19 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leukemias</td>
<td>32%</td>
<td>20%</td>
<td>30%</td>
<td>40%</td>
<td>37%</td>
<td>23%</td>
</tr>
<tr>
<td>CNS tumors</td>
<td>18%</td>
<td>13%</td>
<td>17%</td>
<td>17%</td>
<td>21%</td>
<td>17%</td>
</tr>
<tr>
<td>Lymphomas</td>
<td>11%</td>
<td>2%</td>
<td>2%</td>
<td>5%</td>
<td>10%</td>
<td>21%</td>
</tr>
<tr>
<td>Neuroblastomas</td>
<td>6%</td>
<td>21%</td>
<td>15%</td>
<td>10%</td>
<td>4%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Soft tissue sarcoma</td>
<td>6%</td>
<td>2%</td>
<td>3%</td>
<td>3%</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>Wilms tumor</td>
<td>5%</td>
<td>1%</td>
<td>0%</td>
<td>8%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>Germ cell tumors</td>
<td>5%</td>
<td>15%</td>
<td>5%</td>
<td>3%</td>
<td>3%</td>
<td>6%</td>
</tr>
<tr>
<td>Retinoblastomas</td>
<td>4%</td>
<td>0.8%</td>
<td>0.5%</td>
<td>2%</td>
<td>5%</td>
<td>8%</td>
</tr>
<tr>
<td>Thyroid cancer</td>
<td>2.5%</td>
<td>0%</td>
<td>0%</td>
<td>0.3%</td>
<td>1.5%</td>
<td>7%</td>
</tr>
<tr>
<td>Melanoma &amp; skin cancer</td>
<td>1.6%</td>
<td>0%</td>
<td>0.2%</td>
<td>0.6%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>Other tumors</td>
<td>8%</td>
<td>20%</td>
<td>15%</td>
<td>11%</td>
<td>6.5%</td>
<td>3%</td>
</tr>
</tbody>
</table>
Diagnosis of Pediatric Cancer
- ~85% of pediatric cancer is symptomatic
- Difficult to detect in early stages
  - Non-specific, insidious symptoms are similar to more common childhood illnesses

Early Warning Signs of Pediatric Cancer
- Continued, unexplained weight loss or loss of appetite
- Headaches with vomiting in the morning
- Increased swelling or persistent pain in bones or joints, sometimes accompanied by limping, inability to bear weight, pathologic fractures
- Lump or mass in abdomen, neck, or elsewhere
- Development of a whitish appearance in the pupil of the eye, sudden changes in vision, dark circles, or droopy eyelids
- Recurrent fevers not caused by infections
- Excessive bruising or bleeding (often sudden onset)
- Noticeable paleness or prolonged tiredness

When should I suspect cancer in my patient?
- Continued, unexplained weight loss or loss of appetite
- Headaches with vomiting in the morning
- Increased swelling or persistent pain in bones or joints, sometimes accompanied by limping, inability to bear weight, pathologic fractures
- Lump or mass in abdomen, neck, or elsewhere
- Development of a whitish appearance in the pupil of the eye, sudden changes in vision, dark circles, or droopy eyelids
- Recurrent fevers not caused by infections
- Excessive bruising or bleeding (often sudden onset)
- Noticeable paleness or prolonged tiredness

- Our role is not to diagnose cancer
- Our role is to suspect cancer based upon clinical signs and symptoms, refer for urgent evaluation, and provide appropriate supportive care to the patient

- Difficult to detect in early stages
  - Non-specific symptoms
- Diagnostic methods
  - Clinical examination
  - Laboratory
  - Imaging studies
  - Bone marrow aspiration
  - Biopsy
- Median time to diagnosis: 21 - 72 days
Objectives:
- Arrest dental disease / restore oral health
- Prevent and manage complications from therapy

Dental concerns:
- Immune compromise
- Potential for oral infection
- Risk of bleeding
- Indwelling catheters

New Malignancy: Dental Protocol
- Dental baseline evaluation for cancer therapy
- Examination with radiographs
- Remove fixed orthodontic appliances and retainers
- Caries arresting, restorative, and surgical treatment(s) per patient needs
- Establish optimal oral hygiene program

Why Remove Fixed Orthodontic Appliances?
- Protect integrity of oral mucosa
- Facilitate oral hygiene
- Orthodontic tooth movement will be compromised by chemotherapy
- Metal interferes with MRI imaging
- Relieve overall burden of health care

Pediatric Cancer Treatment
- Chemotherapy
  - Used for almost all pediatric patients
  - Intensive, often requires hospitalization
- Surgical resection
- Radiation therapy
- Immunotherapy
- Hematopoietic stem cell transplant
- Combinations

Pediatric Cancer Treatment
- Best Available Treatment (BAT) is determined by risk categories
  - Disease
  - Patient age and gender
  - Staging
  - Metastasis
  - DNA of malignant cells
  - Presence or absence of oncogenes
Treatment of Standard Risk ALL
- Induction to complete remission
  - Multi agent chemotherapy
  - Bone marrow aspirations to monitor progress
  - Intrathecal chemotherapy for CNS prophylaxis
- Consolidation
  - Multi agent chemotherapy with different drugs than drugs used for induction
- Delayed intensification
  - Pulses of intensive multi agent chemotherapy
- Maintenance
  - Multi agent chemotherapy

Treatment of High Risk Medulloblastoma for Patients ≥ 3 Years
- Local control
  - Surgical resection
  - Placement of shunt to relieve hydrocephalus if needed
- Control residual disease
  - Radiation therapy to craniospinal axis with boost to tumor
  - Multi agent chemotherapy
  - Autologous hematopoietic stem cell rescue
- Monitor tumor with brain/spine MRI q 6 months

Childhood Cancer Survivors
- A cancer survivor refers to any person who has been diagnosed with cancer
- Survivorship begins on day 1, at the time of diagnosis
- Includes:
  - Initial treatment periods with intent to cure
  - Post treatment cancer-free survival
  - Post treatment chronic or intermittent disease
  - Post treatment palliative care

Current Outcomes of Childhood Cancer
- ~ 20% die in years 1 - 5
- 14% die in years 6 - 30
- 19% survive at least 30 years but have life threatening or disabling chronic health conditions
- 25% survive at least 30 years but suffer mild or moderate chronic health conditions
- 22% survive at least 30 years without chronic health conditions

Childhood Cancer Survival
- Survival rates are improving with advances in therapy
  - Improved treatment with less toxicity for low-risk patients
  - Rates vary by cancer type and stage, gender, age
- 70 - 80% five year survival rate for all pediatric cancers
  - Males have higher mortality rate than females
  - Adolescents have higher mortality rate than younger children
  - Better screening for health issues related to cancer treatment
  - Better medical care for late effects of therapy

Childhood Cancer Survival Care Plan
- Survivorship care plan for CCS is created by the oncology team at completion of active treatment
- CCS are generally followed by oncology team during the period of highest risk for disease recurrence (5 years or longer)
- Consistent medical and dental surveillance needed
- Risk of late effects increases over time
Late Effects of Treatment
- Secondary malignancies
- Abnormal bone or muscle growth
- Cognitive deficits
- Psychosocial issues
- Cardiac damage
- Reduced lung function
- Infertility
- Endocrinopathies
- Treatment related obesity and metabolic syndrome
- Hearing loss

Bone Problems in CCS
- Children are vulnerable due to rapid bone growth and turnover
- Reduced vascularity in areas treated with radiation
- Avascular necrosis (osteonecrosis) of bone underlying articular surface of joints
  - Primarily weight bearing joints of the legs
- Altered epiphyseal growth
- Reduced bone mineral density
  - May be taking anti-catabolic medication that suppress bone remodeling (bisphosphonates)

Endocrinopathies in CCS
- Hypothalamic – pituitary gland dysfunction
- Thyroid dysfunction
- Gonadal dysfunction
  - Failure to enter or complete puberty
  - Infertility
- Poor linear growth
- Low bone mineral density
- Metabolic conditions: obesity and diabetes mellitus

Craniofacial / Dental Abnormalities in CCS
- Incidence 30 – 95 %
- Factors influencing risk and severity
  - Patient age at diagnosis
    - Increased risk if treated before age 8 years
  - Stage of tooth development / craniofacial growth
  - Therapy type and dose
    - Cranial radiation causes most damage
    - Intense chemotherapy has large impact

Craniofacial Abnormalities in CCS
- Microcephaly
- Facial deformities and asymmetries
- Skeletal hypoplasia
- Trismus
  - Atrophy / fibrosis of masticatory muscles
  - Compromised alveolar development
  - Decreased microvascularization if treated with radiation
Dental Abnormalities in CCS
- Agenesis / hypodontia
- Enamel dysplasia
- Root hypoplasia
  - V shape, blunting, altered root number
- Microdontia
- Salivary gland dysfunction
- Increased dental caries risk
- Increased risk of periodontal disease

Orthodontic Wishes
- Healthy and psychologically resilient patient
- Supportive and interested parents
- Normal and symmetric craniofacial growth
- Healthy bone, capable of therapeutically induced remodeling
  - Thick periodontium
  - Full complement of normally shaped teeth
  - Class 1 relationships

Orthodontic Challenges for CCS
- Craniofacial growth may be unfavorable
- Cannot relay upon growth to help correct malocclusion
- Bone may not respond normally to orthodontic forces
- All teeth may not be viable
- Orthodontic brackets do not fit very small teeth
- May need to coordinate complex treatment with pediatric dentists, prosthodontists, and oral surgeons
Quality orthodontic outcomes result from a correct diagnosis, appropriate treatment goals, and optimal mechanics in a compliant patient. And permanent retention.

- Medical history
  - History specific to malignancy and its treatment
  - Dental history
  - Clarify orthodontic concern of patient / parent
  - Clinical examination and records
  - Make orthodontic diagnosis
  - Set orthodontic treatment goal(s)
  - Consider orthodontic treatment options
  - Obtain informed consent

- Age at diagnosis
- Disease and staging at diagnosis
- Type of treatments
- Date end of active cancer treatment
- Date and type of recurrence
- Ongoing cancer-related treatment
- Ongoing cancer-related conditions
- Surveillance plan and type of monitoring
- Date of most recent surveillance appointment

**Self report may be unreliable**

Why do CCS seek orthodontic treatment?

Same reasons as most orthodontic patients!
- Improve appearance
- Improve oral health and function
- Provide “typical” child/teen life experience

Cancer History