INTRODUCTION

Oral ulceration is a common complaint in children and adolescents. Though often unalarming, it can be an indicator of a serious underlying condition, which can be challenging to differentiate from the benign. Ulceration is often associated with pain or discomfort which, when recurrent, can be significant and impact on quality of life.1

Reflecting on experience from a tertiary dental paediatric service, this article aims to support clinicians in the investigation, diagnosis and management of patients presenting with oral ulceration; identifying the pathognomonic signs of serious underlying conditions, knowing how to signpost patients and providing immediate symptomatic management.

Oral ulceration is defined as a break in the oral mucosa that extends into the submucosa and breaches the lamina propria.2 It presents with varying appearances determined by the underlying cause. The most common appearance is a circular lesion with grey/yellow base and surrounding erythema. This is often associated with pain which can be exacerbated by mechanical or chemical stimuli, for example, tooth brushing, spice. Figure 1 shows typical ulcer presentation. A detailed history is essential to differentiate between the causes of oral ulceration. While helping to identify potential serious underlying causes, a thorough history can also prevent unnecessary investigation of conditions which may be self-limiting. Table 1 summarises the key history taking questions to help you differentiate between causes.

DIFFERENTIAL DIAGNOSIS OF ORAL ULCERS

Single episode

Traumatic ulceration

The most common cause of a single ulcer is trauma.3 Traumatic ulceration is usually caused by sharp teeth or a dental appliance (eg, brace) breaking the oral mucosa and is usually associated with pain. They persist until the underlying cause of trauma is removed. Once removed, the ulceration will typically resolve within 2 weeks.

Example case 1

A 10-year-old child presents with an ulcer on the buccal mucosa. The child was systemically well but complained of localised discomfort. They had recently begun wearing a removable dental appliance. Likely diagnosis is traumatic ulceration which may be resolved by adjustment of the appliance. Provide symptomatic management and advise patient to see their dentist (see figure 2).

Viral ulceration

A single episode of multiple oral ulcers is commonly viral in origin. Where widespread oral ulceration and pain is presented in a child with fever and malaise,4 herpes simplex 1 (HSV-1) presenting as primary herpetic stomatitis is a common cause. Ulceration affects all oral tissues, often including the tongue and lips. HSV-1 is self-limiting and should resolve in 7–10 days. The combination of high temperature and poor oral intake as a result of painful ulceration can lead to dehydration of more significance than the original viral infection.5 Further advice should be sought for immunocompromised children.
Other viral causes include coxsackie virus (herpangina/hand-foot-mouth disease) which typically affects children under 10 years-old. Presentation is similar to HSV-1 but ulceration is often limited to posterior oral cavity (soft palate, tonsils, uvula). Due to the contagious nature of the condition, a child will often present during a nursery/school outbreak.

**Example case 2**

A 6-year-old child presents with a 2-day history of multiple oral ulcers. The child has fever and malaise. Parents report significantly reduced oral intake. There was no previous history of ulceration. It was likely caused by primary herpetic gingivostomatitis (figure 3).

Squamous cell carcinoma

If a patient presents with a non-healing painless single ulcer, persisting for over 3 weeks with no underlying cause, neoplasm should be considered. However, oral malignancy is very rare in paediatric patients (0.1–0.3 in 100 000). If suspected, refer urgently via rapid access pathway for oral cancer (figure 4).

**Recurrent ulcers**

Single site recurrent ulcerations are commonly caused by trauma where the origin has persisted. This may also be an indication that ulceration is self-inflicted (figure 5) or caused by foreign bodies entering the oral cavity. This may be seen in patients with learning difficulties or Pica, where patients attempt to consume non-food items which may be damaging to the mucosa.

Recurrent ulceration at variable sites can be more challenging to diagnose and again relies on a thorough history. Removal of the cause should prevent recurrence of the ulcer. For children where Pica is suspected, support can be sought from a paediatrician.

Recurrent aphthous stomatitis

Recurrent aphthous stomatitis (RAS) is a common diagnosis affecting 20% of the population and typically presents in childhood (figure 6). RAS is likely the result of T-cell immune mediated dysfunction, with a genetic component of up to 46% of cases having a family history of the condition. Most cases are idiopathic but can be exacerbated by underlying factors including hormonal changes, stress, anaemia/hematocrit deficiencies (eg, iron, folate, B12) and oral sensitivities to products (eg, sodium lauryl sulfate (SLS), a foaming agent found in many toiletries such as toothpaste) or foods (such as cinnamon).

Three variants of RAS exist and are outlined in table 2, the minor form is the most common presentation in children. Herpetiform is characterised by recurrent crops of small multiple ulcers. Unlike the name suggests, these ulcers are not of viral origin.

Orofacial granulomatosis

Orofacial granulomatosis (OFG) is a chronic inflammatory condition characterised by facial (often lip) swelling and oral ulceration with a typical ‘cobbledstone’ appearance of the oral mucosa (figure 7). OFG can be linked to Crohn’s disease and some patients will present with GI symptoms. If there are features of anorexia, weight loss, abdominal symptoms such as change in bowel habit or chronic...
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diarrhoea, consider inflammatory bowel disease or coeliac disease.

A diagnosis of OFG can be made with the presence of the clinical features described and a lip biopsy may be considered, confirming the presence of non-caseating granulomas. While the exact cause of OFG is unknown, exacerbation can be linked to sensitivities, most commonly benzoates and cinnamaldehyde. Starting an exclusion diet can help to relieve symptoms and allergy testing may confirm sensitivities. Hygiene products and toothpastes containing cinnamon and benzoates should be eliminated.

Immunosuppression
Recurrent oral ulceration can be an indication of immunosuppression (figure 8). If immunocompromised or undergoing chemotherapy or radiotherapy, oral mucositis (pain and sloughing of the oral mucosa) may present. Management focuses on symptom relief and we would advise liaising with the patient’s Oncology team.

Immunocompromised patients may present with prolonged healing of existing ulceration or more frequent episodes of recurrent ulceration, such as RAS. Candida and gingival inflammation may also be present.

Acute lymphoblastic leukaemia is a more prevalent neoplastic presentation in children. Sixty-five per cent of patients with leukaemia present with oral symptoms; however, this is not commonly ulceration. Initial oral presentation can include pale mucosa, gingival overgrowth and bleeding from the gums.

Lichen planus
Oral lichen planus (OLP) is a less common presentation of oral ulceration in children. OLP is a chronic, inflammatory disease of the skin and mucous membranes. Classically, a white surface appearance occurs which is caused by keratinocyte hyperproliferation as a result of chronic inflammation (figure 9). Lesions may also present on the scalp, skin, genitalia and nails. If present, pain is often exacerbated by spicy foods and sodium lauryl sulfate. Patients will require referral to oral medicine.

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Figure 2 An example of an upper removable appliance (brace) which caused traumatic ulceration to the tongue. (A) Traumatic ulceration. (B) Example of an upper removal appliance in the mouth (C) Healing ulceration.

Figure 3 Oral presentation of primary herpetic gingivostomatitis. (A) Inflamed gingiva with areas of erosion. (B) Crusted lips and ulceration of the tongue.

Figure 4 Squamous cell carcinoma of tongue in paediatric patient with Fanconi anaemia.

Figure 5 Oral ulceration as a result of self-injurious behaviour in a patient with autism. Patient is known to regularly 'itch' gums.
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Example case 3
A 14-year-old child presents with a history of painful recurrent oral ulcers. Ulcers vary in location with approximately 4–5 mm diameter. They last on average 7 days, mainly occurring during examination periods. Mum had similar lesions as a child. It is likely RAS (figure 10).

Table 3 provides a summary of some of the causes of oral ulceration in children along with their associated factors (table 3).

INVESTIGATIONS
Diagnosis of oral ulceration is primarily based on clinical presentation. To reach a diagnosis and determine management, history and examination should be supported by photographs, ulcer and pain diaries.

Clinical investigation beyond a thorough history should be carefully considered. Where there appears to be a systemic cause, blood tests including FBC, haematins and inflammatory markers could provide valuable information to influence management. Where a local or self-limiting cause is suspected, this information is unlikely to alter management.

Some presentations would benefit from input from other specialities with more specialised investigation for example, biopsy, immunofluorescence. These should only be requested on the instruction of the associated specialty.

Table 2 Clinical variants of recurrent aphthous stomatitis (RAS)\textsuperscript{19}

<table>
<thead>
<tr>
<th></th>
<th>Minor</th>
<th>Major</th>
<th>Herpetiform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Single to few ulcers</td>
<td>Single to few ulcers</td>
<td>Multiple ulcers 10+</td>
</tr>
<tr>
<td>Location</td>
<td>Most common on labial and buccal mucosa and floor of the mouth</td>
<td>Often present on lips, soft palate and fauces</td>
<td>Often present on labial and buccal mucosa and floor of the mouth</td>
</tr>
<tr>
<td>Size</td>
<td>&lt;1 cm diameter</td>
<td>Deep and &gt;1 cm</td>
<td>Small, &gt;5 mm but multiple ulcers may group to form a larger lesion</td>
</tr>
<tr>
<td>Duration</td>
<td>Heal within 10–14 days</td>
<td>Persist for up to 6 weeks</td>
<td>Last for about 10–14 days</td>
</tr>
<tr>
<td>Healing</td>
<td>No scarring</td>
<td>Possible scarring</td>
<td>Possible scarring particularly when grouped ulceration occurs</td>
</tr>
</tbody>
</table>

Figure 6 Recurrent aphthous ulceration. (A) Major aphthous ulcer on lateral aspect of the tongue. (B) Minor aphthous ulcer on lower labial mucosa.

Figure 7 Oral features of orofacial granulomatosis. (A) Oral ulceration. (B) Lip swelling and crusting.
**PRINCIPLES OF MANAGEMENT**

Primary management focuses on removal of causes/predisposing factors and managing symptoms. During acute presentation, the risk of dehydration should be considered. If unable to rehydrate due to pain, hospital admission should be considered to support hydration.

Table 3 provides advice for management of the pain associated with ulceration.

Patient’s age and compliance is considered when prescribing oral medicaments. Topical agents have a

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**Table 3**  Summary of some causes of ulceration in children and their associated factors

<table>
<thead>
<tr>
<th>Cause</th>
<th>Association</th>
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<tbody>
<tr>
<td>Trauma</td>
<td>► Often single ulcer in location of irritation</td>
</tr>
<tr>
<td></td>
<td>► May be caused by removable appliance, sharp tooth with identified cause</td>
</tr>
<tr>
<td></td>
<td>► of irritation</td>
</tr>
<tr>
<td></td>
<td>► Self-inflicted ulceration (Pica) can be associated with children with</td>
</tr>
<tr>
<td></td>
<td>► learning disabilities</td>
</tr>
<tr>
<td></td>
<td>Removing the cause should resolve the ulcer</td>
</tr>
<tr>
<td>Viral</td>
<td>► Often multiple painful ulcers</td>
</tr>
<tr>
<td></td>
<td>► Systemic symptoms such as fever, malaise</td>
</tr>
<tr>
<td></td>
<td>► May be associated with nursery/school outbreak</td>
</tr>
<tr>
<td></td>
<td>► Includes: HSV-1, Coxsackie virus</td>
</tr>
<tr>
<td></td>
<td>Ulcers are usually self-limiting</td>
</tr>
<tr>
<td>Bacterial Infection</td>
<td>► Pain and halitosis</td>
</tr>
<tr>
<td></td>
<td>► Can coincide with poor oral hygiene and swelling/inflammation of gingiva</td>
</tr>
<tr>
<td></td>
<td>► May have bleeding from the gums</td>
</tr>
<tr>
<td></td>
<td>► Children with underlying immunosuppression are more likely to present</td>
</tr>
<tr>
<td></td>
<td>► with infections</td>
</tr>
<tr>
<td></td>
<td>May require antibiotics, support from dentist with oral health</td>
</tr>
<tr>
<td>Recurrent aphthous stomatitis</td>
<td>► Multiple recurring ulcers</td>
</tr>
<tr>
<td></td>
<td>► May be family history of recurrent ulceration</td>
</tr>
<tr>
<td></td>
<td>► Appearance of ulcers often follow a pattern</td>
</tr>
<tr>
<td></td>
<td>► Triggers include hormonal changes, stress, anaemia/haematonic deficiencies and oral sensitivities</td>
</tr>
<tr>
<td></td>
<td>► Present in major, minor and herpetiform types</td>
</tr>
<tr>
<td></td>
<td>Any underlying deficiencies should be corrected</td>
</tr>
<tr>
<td>Inflammatory conditions</td>
<td>► Associated cobbling of mucosa/lip swelling</td>
</tr>
<tr>
<td></td>
<td>► Include orofacial granulomatosis and inflammatory bowel disease</td>
</tr>
<tr>
<td></td>
<td>► Associated GI symptoms</td>
</tr>
<tr>
<td></td>
<td>► Triggered by allergic reaction, that is, benzoates and cinnamon</td>
</tr>
<tr>
<td></td>
<td>Referral to appropriate specialty for further investigation of underlying cause</td>
</tr>
</tbody>
</table>
limited duration and require multiple applications, particularly prior to eating to support oral intake. For single ulcers or younger patients who cannot tolerate mouthwash, oral sprays are beneficial. In older children or for widespread lesions, a mouthwash may be appropriate. Where a mouthwash has been recommended for symptomatic relief, this is not an alternative to tooth brushing and should be used at an alternative time to avoid diluting the medicinal properties of fluoride toothpaste.

It is important that patients are encouraged to maintain/improve oral hygiene. This can be challenging as tooth brushing may exacerbate pain. However, if oral hygiene becomes compromised it leads to plaque/bacteria accumulation which can exacerbate ulceration or cause secondary infection. As oral ulceration can be a chronic issue, the child’s local dentist should provide specific toothbrushing support.

Twice daily brushing with fluoride toothpaste is recommended for dentate children. It may be pertinent for children to use sodium lauryl sulfate (SLS) free toothpastes, such as Oranurse, to avoid exacerbation of symptoms (figure 11). Kingfisher or Sensodyne Fresh Mint toothpaste are free from both benzoates and SLS.

In the first instance, mouthwashes (table 4) can be advised or prescribed. Antimicrobial mouthwashes can reduce secondary infection and support oral hygiene. Doxycycline as a mouthwash may be effective in patients with RAS. Topical local analgesics/anti-inflammatories can support symptom management and can be prescribed alone or as an adjunct. Topical corticosteroids, including hydrocortisone and betamethasone are advised for management of RAS or more severe oral ulceration. The Scottish Dental Clinical Effectiveness Programme ‘Drug Prescribing for Dentistry’ can be consulted for further support.18

Table 4 guides in prescribing symptomatic relief for all types of oral ulceration. Unless stated otherwise, medicaments should be used continuously during symptomatic periods. The BNFc should be consulted for doses and contraindications. Prescriptions should be sugar free to avoid dental caries.
CONCLUSION
Although oral ulceration is a common clinical presentation in paediatric patients, due to the broad range of differentials, diagnosis can prove challenging. Thorough history taking is a critical step towards diagnosis and should consider a range of local and systemic factors. Clinicians should be aware of red flag symptoms which may indicate more serious underlying causes for example, non-healing ulcers, weight loss, night sweats, GI symptoms and be able to signpost these patients effectively to the relevant specialists. Additionally, clinicians should be able to support symptomatic management though oral hygiene, anti-inflammatory agents and local anaesthetics to reduce discomfort, poor oral intake or long-term QoL impact.

Test your knowledge

1. A patient presents with oral ulceration and subsequent pain linked to a recent change in toothpaste. The offending agent in the toothpaste is likely to be:
   a. Glycerol
   b. Phosphate
   c. Sodium fluoride
   d. Sodium lauryl sulfate
2. Herpetiform ulcers are:
   a. A variant of recurrent aphthous stomatitis
   b. Caused by herpes simplex virus
   c. Caused by trauma
   d. Likely to present as a single ulcer
3. Which of the following is not associated with orofacial granulomatosis
   a. Cobblestoning of the mucosa
   b. GI symptoms
   c. Lip swelling
   d. White Strai ulceration
4. When providing oral hygiene advice for children presenting with oral ulceration this should include:
   a. Continue to brush teeth twice a day
   b. Do not brush the teeth if ulceration causes pain
   c. Rinse with an antiseptic mouthwash after toothbrushing
   d. Stop using a fluoride toothpaste
5. For a child aged 9 presenting with painful traumatic ulceration the following management should not include:
   a. Advise follow-up with local dentist to remove cause of trauma
   b. Arrange review in 2–3 weeks to ensure ulcer has healed
   c. Prescription of a chlorhexidine mouthwash to use at an alternative time to toothbrushing
   d. Referral to local dental specialty for persisting ulcer

Answers to the quiz are at the end of the references.

REFERENCES
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Answers to the multiple choice questions

1. (a) False; (b) False; (c) False; (d) True.
2. (a) True; (b) False; (c) False; (d) False.
3. (a) False; (b) False; (c) False; (d) True.
4. (a) True; (b) False; (c) False; (d) False.
5. (a) False; (b) False; (c) True; (d) False.