With recent advances in MR sialography, is conventional sialography still relevant in current clinical practice?

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Learning objectives

Inflammatory conditions are the most common pathology affecting salivary glands. These include sialoadenitis, sialolithiasis, salivary duct strictures, duct stenosis and sjogrens syndrome.

Imaging of the major salivary gland ductal system is vital in the diagnosis of these conditions and sometimes aids in their management.

1. We aim to review conventional sialography techniques including the less well described technique using orthopantomogram unit.

2. Compare with MR-sialography and describe advantages, disadvantages and pitfalls.

3. Illustrate the imaging findings in a variety of salivary duct diseases using both imaging modalities.
Background

Conventional or digital-subtraction sialography (CRS) has long been considered the gold standard for imaging the salivary ductal system.

Advantages of CRS:

- Offers excellent anatomic detail and spatial resolution.
- 4th order ducts can be visualised and subtle abnormalities detected.
- Offers the opportunity to dilate ductal strictures and retrieve small ductal calculi.

Disadvantages of CRS:

- Invasive technique involving cannulation of the salivary ductal orifice with a reported failure rate between 10-15%.
- Risk of bleeding, trauma and stricture development.
- Strictures close to the orifice can be missed due to the need for cannulation.
- Retrograde contrast injection to opacify the ductal system has a risk of infection and may displace an anteriorly placed ductal stone posterior making it difficult to retrieve.
- Involves exposure to radiation and use of contrast media.

Positioning the patient in CRS can be tedious and it can sometimes be difficult to acquire quality images.

We describe the less known method of Pantomographic Sialography (PS) using the orthopantogram unit.

Advantages of PS over CRS:

- Provides a panoramic view of the salivary gland duct in a single image without much discomfort to the patient in positioning.
- The superimposition of surrounding tissues is avoided thereby providing excellent quality images.
- The imaging distortions are minor.
- More than one gland can be imaged at the same time.

Disadvantages of PS:

- Fluoroscopic visualisation during contrast injection to opacify the salivary duct is not possible and contrast is injected blindly.
- Availability of an OPG unit is necessary.
Contraindications of CRS and PS:

- Contraindicated in acute/sub-acute sialadenitis due to the risk of exacerbating the infection.
- Patients with contrast allergy.

With the introduction of newer Magnetic Resonance (MR) techniques, MR Sialography (MRS) is being used as a non-invasive alternative to imaging the salivary ducts and glands with comparable results.

MRS exploits inherent tissue contrast on heavily T2 weighted sequences, achieving good ductal detail without the introduction of additional contrast media.

Advantages of MRS:

- Non invasive.
- No risk of ductal injury or post procedure strictures.
- Can be performed in acute sialadenitis.
- Detailed evaluation of major ducts and salivary glands as well.
- No exposure to ionising radiation or contrast media.

Disadvantages of MRS:

- Limited spatial resolution as compared to CRS.
- MR interpretational pitfalls and artifacts.
- General contraindications to MRI.
- Limited resources and availability of the MR unit

MRS Pitfalls:

- MR sialography uses a highly T2 weighted sequence. Although long echo train causes excellent ductal visualisation this is at the cost of background signal suppression. Therefore small ductal calculi may be obscured by the very bright surrounding saliva. Equally small ductal calculi may be misinterpreted as focal strictures.
- Similarly although MIP (maximum intensity projection) provides excellent anatomical details, signal averaging can obscure small calculi. Thus the raw data set must be carefully analysed.
- Artefacts from orthodontic prosthesis, saliva and patient movement can give rise to suboptimal images and interpretational difficulty.
Imaging findings OR Procedure details

The parotid gland duct (stensen's duct) opens into the oral cavity opposite to the crown of upper second molar tooth. The submandibular gland duct (Wharton's duct) opens into in the anterior floor of the mouth lateral to the frenulum.

Pantomographic technique:

Control OPG view is taken. When only one gland is being imaged it is possible to reduce the radiation exposure by starting or stopping half way through the full arc of the tube.

The salivary gland duct is cannulated using a appropriate size robinov sialography set (0.016 inches for the wharton's duct and 0.032 inches for the stensen's duct) . A blunt tip needle on a polythene catheter or a silver cannula can also be used.

1.5 to 3 ml of nonionic iodinated contrast (iopamidol 300mg I/ ml) is injected till patient experienced some pain, after which images are obtained as following:

For Submandibular gland:

The patients head is positioned on the OPG unit with the chin slightly advanced and elevated to avoid superimposition of the hyoid bone on the submandibular gland.

The centring point is 2-3 cm lower than for standard OPG examination for teeth.

For Parotid gland:

The patients head is positioned on the OPG unit slightly facing away from the side to be examined . This increases the distance between the mandibular angle and cervical spine so that the parotid gland can be seen without superimposed bone.

5 minute delayed images are obtained similarly after administration of sialagogue like citric acid.
Fig. 1: OPG Submandibular Sialography showing normal wharton's duct and its 1st and 2nd order branches. Note the panoramic view of the salivary gland duct without superimposition of surrounding tissues.

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**Fig. 2:** Lateral (A) and Tangential (B) views using Conventional Sialography technique show a normal stensen’s duct. Notice the 1st and 2nd order branches are clearly demonstrated.

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Fig. 3: Normal Stenson’s duct on MR Sialogram using highly T2 weighted imaging. Notice the main duct is clearly demarcated but secondary and tertiary branches are not visible.

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**Fig. 4:** OPG submandibular sialography shows a distal wharton's duct calculus.

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**Fig. 5:** Control (A) and post contrast injection (B) images of a submandibular gland OPG sialogram showing a large proximal calculus.
**Fig. 6:** 4mm filling defect in the stensen’s duct in keeping with a calculus.

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Fig. 7: Heavily T2W images shows abrupt cut off in the wharton's duct due to a 5mm calculus with proximal dilatation.

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Fig. 8: OPG Submandibular Sialography shows a stricture of the submandibular duct with proximal dilatation.

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Fig. 9: OPG sialography of the submandibular gland shows a short proximal stricture of the wharton's duct.

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**Fig. 10:** OPG Sialography of the Submandibular gland shows a distal stricture close to the orifice of the Wharton's duct. There is proximal dilatation of the duct.

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**Fig. 11:** Post contrast injection (A) and post sialogouge (B) images of a OPG submandibular sialogram show a distal Wharton's duct stricture with proximal dilatation. The duct does not empty on post sialogouge images (B).
Fig. 12: Conventional Submandibular Sialogram again shows a distal stricture of the wharton’s duct with proximal dilatation (A). The wharton’s duct does not empty on post sialogouge image (B). There are intraglandular ductal strictures with evidence of sialectasis as well.
**Fig. 13:** Short stricture involving the mid parotid duct. Note the high T2W signal in the parotid gland which is enlarged in keeping with acute sialadenitis.

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**Fig. 14:** Axial T2W and MIP images show a smooth stricture in the distal stensen's duct.

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Fig. 15: Conventional Parotid gland Sialography shows beading of stensen's duct and 1st and 2nd order ducts in keeping with multiple intra glandular strictures and sialectasis. The ducts remained dilated on post sialogouge views.

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**Fig. 16:** Sjogrens on conventional sialography: Diffuse dilation of primary and secondary ducts with multiple punctate intra glandular lesions in keeping with acinar dilatation.

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**Fig. 17:** Sjogren's Syndrome on MRI: Standard axial T2W with fat saturation (A) and heavily T2W (B) images show diffuse dilation of primary and secondary ducts with multiple punctate intra-glandular lesions in keeping with dilated acini.

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**Fig. 18:** Sjogren's Syndrome: Sagittal MIP image demonstrates diffuse dilation of the primary and secondary ducts with multiple punctate intra glandular lesions in keeping with acinar dilatation.

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**Fig. 19:** Benign parotid cyst. It is possible to assess the salivary glands as well on MR sialography.

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Fig. 20: Well circumscribed homogeneous mass in the parotid gland which shows low signal intensity on T1 and high on T2, and is in keeping with a parotid adenoma.

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Conclusion

With improvement in crosssectional imaging techniques and advent of new MR techniques, there has been a reduction in the indications for x-ray sialography in recent years. However, sialectasis, radiopaque sialoliths, and postinflammatory ductal strictures continue to be best visualized with conventional sialography. The sensitivity and specificity of diagnosing these conditions using CRS has been reported to be greater than 95%.

We revisit the long forgotten technique of Pantomographic Sialography with image illustration.

The current role of Conventional and MR Sialography is illustrated using a variety of imaging findings. Given the advantages and disadvantages of each modality, individualised approach is often required in the investigation and management of patients with salivary ductal diseases.
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