



Louis Mackenzie

Mike Waplinton and Steve Bonsor

Splendid Isolation: a Practical Guide to the Use of Rubber Dam

Part 1

Abstract: Rubber dam isolation is generally considered to be the optimal method of moisture control in dentistry and is taught at the majority of dental schools worldwide. Unfortunately, undergraduate training does not always translate into use in dental practice, with the majority of clinicians never using a rubber dam, even for endodontic procedures, where its use is regarded as best practice in the United Kingdom (UK) and elsewhere. The COVID-19 pandemic has increased interest in the use of rubber dam as a highly effective infection control barrier. As professional and patient experience of rubber dam isolation is extremely limited, these two papers are designed to support the practical training of clinical teams in the confident, skilful use of rubber dam, to outline its advantages and to help overcome barriers to its routine use. Part one provides an update of the latest equipment and materials for rubber dam isolation and part two provides a practical guide to rubber dam isolation techniques for endodontic and operative/restorative procedures.

CPD/Clinical Relevance: Mastering rubber dam isolation will enhance patient care and be professionally rewarding for clinical teams. **Dent Update 2020; 47: 548–558**

Timing of the introduction of rubber dam to dentistry is famously precise; the first reported use was by Dr Sanford C Barnum on 15 March 1864.¹ Since then, rubber dam teaching has been progressively introduced at the vast majority of dental schools worldwide. In the UK, rubber dam placement is also within the scope of

practice of dental therapists and dental nurses who have received appropriate training.

Rubber dam is universally recognized as the optimal method of moisture control, and its use is considered to be best practice in the UK and internationally during endodontic treatment.² However, the majority of clinicians never use it or use it rarely.³ Explanations for the pervasive professional reluctance to adopt the use of rubber dam are well established:

*'Probably no other technique, instrument or treatment in dentistry has been more universally accepted and advocated, and yet is so universally ignored by practising dentists. Many reasons can be given, but in most cases the fundamental cause is inadequate explanation and training in the dental schools. If any operative technique is not clearly taught and seen to be efficiently executed by the teachers, the new members of the dental profession will not use it willingly.'*⁴

Mitigation of the risk of

transmission of SARS-CoV-2 infection has renewed interest in research, advocating the use of rubber dam as an infection control barrier during aerosol and splatter generating procedures,^{4,5,6,7} and its routine use has been strongly recommended by the British Dental Association for this purpose:

*'Rubber dams are very effective in reducing bioaerosols and so where it is possible, it should be used when carrying out AGPs' (aerosol generating procedures)*⁸

Rubber dam has long been recognized as the optimal infection control barrier during endodontic and restorative procedures, enabling a reduction in microorganisms in the operative field.^{5,6,7} Optimal rubber dam isolation in combination with high-volume aspiration, high-quality four-handed techniques and effective use of appropriate personal protective equipment, should be capable of reducing the risk of infectious disease

Louis Mackenzie, BDS, FDS RCPS(Glasg), General Dental Practitioner (GDP), Birmingham, Clinical Lecturer, University of Birmingham; School of Dentistry and Head Dental Officer, Denplan, Winchester, **Mike Waplinton**, BDS, MDentSc, GDP, Specialist in Endodontics; Past President, British Endodontic Society and **Steve Bonsor**, BDS(Hons), MSc, FHEA FDS RCPS(Glasg), MDTFEd, GDP, The Dental Practice, Aberdeen; Hon Senior Clinical Lecturer, Institute of Dentistry, University of Aberdeen; Online Tutor/Clinical Lecturer, University of Edinburgh, Edinburgh, UK.

- Infection control, eg sterile operative field, during aerosol generating procedures
- Moisture control (saliva, blood, gingival crevicular fluid)
- Increased patient comfort during operative/restorative treatments, eg no debris
- Dry field enhances diagnosis
- Increases success of endodontic procedures⁹
- Optimization of adhesive procedures¹⁰
- Protection of the oropharynx (ingestion/inhalation), eg medicaments, debris, instruments, tooth fragments
- Soft tissue retraction and protection, eg rotary instruments, phosphoric acid-etching gel, sodium hypochlorite solution
- Improved visual access, enhanced contrast, reduced mirror fogging
- Significant time saving
- Reduction in treatment interruption, eg reduced need for rinsing
- Possible increased restoration longevity (compared to cotton wool roll isolation)¹⁰
- Reduced exposure to mercury during dental amalgam placement and removal
- Reduced clinician stress/anxiety, significant reduction in pain perception by patients¹¹
- Reduced risk of successful dento-legal clinical negligence claims

Table 1. Advantages of rubber dam isolation.

| Reasons Cited for not Using Rubber Dam | Counterargument/Notes |
|--|--|
| Concerns over patient acceptance | The overwhelming majority of patients prefer treatment under rubber dam ¹² |
| Patient resistance | Once used, patients commonly request rubber dam for subsequent treatments ¹² |
| Time required for application | <90 seconds for most clinical situations Rubber dam may be prepared in advance of patient attendance |
| Application difficulties | Rubber dam use becomes easy and routine after dedicated training and with experience |
| Financial considerations | ~ £0.60 per case |
| Latex allergy | Use of non-latex products predominates |
| Loss of orientation | May be managed with multi-tooth isolation |
| Psychological reasons | Very occasional claustrophobia/gagging may preclude use for restorative procedures NB: Use is considered best practice for endodontic procedures and patients should be advised accordingly ¹ |
| Mucosal, hard tissue or restorative damage from retainers | Plastic retainer alternatives are available (Figure 1) Sharp points on metal retainers may be rounded using suitable rotary instruments (coarse/medium composite shaping discs are recommended) |
| Occlusal restorative assessment cannot be carried out with rubber dam in place | Careful pre-operative occlusal analysis (supplemented by clinical photography) and accurate restorative shaping mitigate the need for major occlusal adjustments (Figure 1) |
| Rubber dam and retainers complicate endodontic radiography | Specialized endodontic sensor/film holders optimize radiographic quality Specialized plastic universal retainers are partially radio-opaque (Figure 1) Effective use of apex locators may eliminate the need for some radiographic exposures |
| Lack of proper training | Educational quality, time and dedication to mastering rubber dam techniques all have a significant impact on rubber dam use as do the curricula of individual dental schools ¹³ |
| Technique sensitivity | Operator/team experience improves patient compliance ¹³ and optimizes all future endodontic and restorative procedures |
| System of remuneration | The majority of UK Health Service dentists never use rubber dam isolation in endodontic treatment ¹³ |
| Choice of endodontic irrigant ¹³ | Sodium hypochlorite is universally recognized as the solution of choice for endodontic irrigation and its use without rubber dam isolation is indefensible. The use of alternative irrigants, eg chlorhexidine, local anaesthetic is not recommended |

Table 2. Barriers to the routine use of rubber dam, alongside well-recognized counterarguments from experienced users.

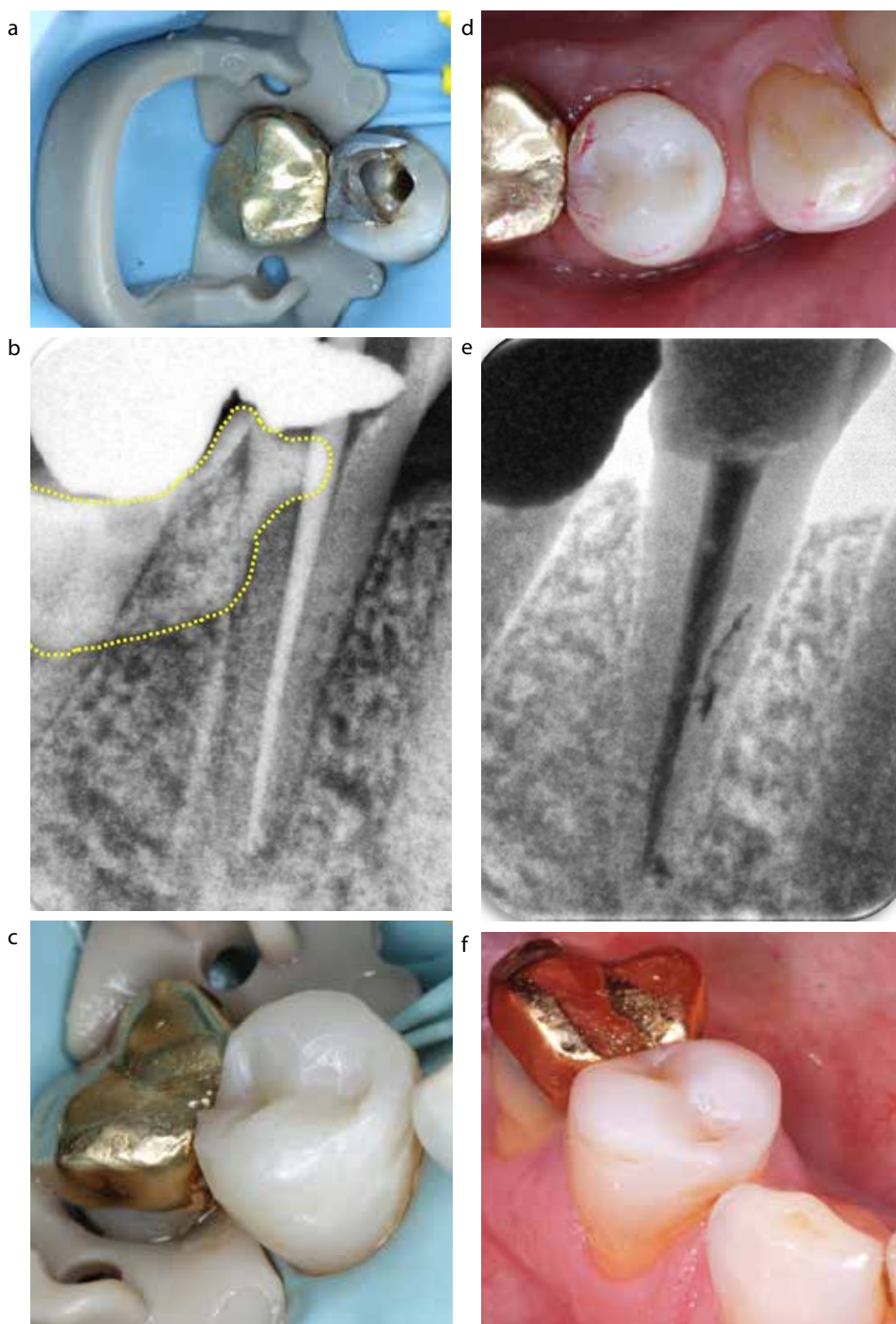


Figure 1. (a) Rubber dam isolation for an endodontic/restorative procedure. (b) Radiolucent SoftClamp™ retainer. (c) All adhesive and direct restorative stages completed using rubber dam. (d) Accurate shaping under dam minimizes/eliminates the need for occlusal adjustment. (e) Rubber dam isolation optimizes endodontic and adhesive/restorative outcomes. (f) Restoration at four years post-operatively.

transmission in dental surgeries close to zero. Accordingly, this paper has three main aims:

1. To support the practical training of

clinical teams in the confident, skilful use of rubber dam isolation as a reliable method of infection control during dental procedures;

2. To outline the other advantages of rubber dam isolation and help clinical teams overcome barriers to its routine use;

3. To provide an update on the latest equipment, materials and clinical techniques for optimizing rubber dam isolation during endodontic and operative/restorative procedures.

Advantages of rubber dam isolation

While rubber dam isolation has gained increased focus during the worldwide COVID-19 pandemic, a wide range of other advantages have been cited, and include those listed in Table 1. Barriers to the routine use of rubber dam are also well documented and are listed, alongside well-recognized counterarguments from experienced users in Table 2.

Clinical case example

Figures 1 (a–f) illustrate the advantages of rubber dam equipment used during the endodontic and restorative treatment of a mandibular right first permanent premolar, including the following:

- The universal plastic SoftClamp™ (Kerr, Bioggio, Switzerland) is suitable for all molar and premolar teeth;
- Isolation optimizes safety and infection control (patient/clinical team) and improves visual and operative access;
- The partially radio-opaque SoftClamp™ still allows diagnostic radiographic information and still facilitates probity checks relating to dam use. (Plastic rubber dam frames also prevent radiographic 'masking');
- Completing all endodontic and direct restorative stages in one procedure maximizes efficiency for both patient and clinical team;
- Adhesion and access for resin composite placement are optimized by moisture control and soft tissue retraction;
- Access for shaping, finishing and polishing procedures is more convenient and more comfortable for patients;
- Accurate shaping minimizes or eliminates the need for adjustment with rotary instruments once the rubber dam is removed;



Figure 2. Two-person teamwork is essential for training and mastery of rubber dam isolation techniques.

- Significantly increased long-term success may be expected from endodontic and restorative procedures carried out using rubber dam isolation.^{7,8}

Rubber dam training

Rubber dam training is optimized by using a two-person team approach with an unrestricted time limit to develop confidence and enable mastery of materials, equipment and clinical techniques (Figure 2). Negative reports of insufficient training may be ascribed to:

- Poor initial learning experiences (in simulation and clinical settings),¹⁴ eg working alone, time limitations, lack of close supervision;
- Practice limitations, eg equipment availability, time restrictions, financial limitations;
- Negative word of mouth, eg rubber dam use is difficult and clinically unnecessary;
- Lack of perseverance following initially discouraging outcomes (Figure 3).

Practical guidelines for rubber dam isolation

The following practical guidelines aim to support both the training of inexperienced



Figure 3. Unsatisfactory simulation (a) and clinical (b) rubber dam isolation outcomes, after training, demonstrate suboptimal knowledge, understanding and clinical technique.

clinical teams and the refinement of equipment, materials and clinical techniques for clinicians who routinely employ rubber dam isolation for endodontic and restorative procedures.

Patient preparation

As most patients have never experienced dentistry carried out under a rubber dam, it is important to explain why it is being used and what to expect. The advantages listed in Table 1 may be summarized to help inform patients of the benefits of rubber dam and additional advice may include:

- Reassuring patients that rubber dam helps enhance their safety and comfort during dental procedures;
- Reminding the patient that they

can breathe and swallow normally, that they will get no debris in their mouth, and that a saliva ejector can be placed under the rubber dam, if necessary;

- Informing patients that the rubber dam retainer (avoid use of the word clamp) will prevent full closure and reminding them not to bite down firmly;
- Asking patients to raise a hand if they have any concerns (usually unnecessary as patients are generally more relaxed once the rubber dam is in place);
- Demonstrating the rubber dam to the patient and explaining the isolation process.

Operative site preparation

Rubber dam isolation should be planned in advance of the patient's attendance and preparation involves a number of considerations:

- Tooth position, arch, crowding, spacing;
- Tooth morphology, eg type, bulbosity, crown height;
- Number of teeth to be isolated and choice of retainer tooth/teeth;
- Tooth state, eg caries, fracture, restoration(s), partial eruption;
- Contact tightness (routinely test contacts using dental floss prior to rubber dam placement/pre-wedging may be carried out to open tight contacts);
- Tooth preparation requirements, eg smooth sharp edges, debride teeth, remove restorations;
- Occlusal contacts should be assessed, marked (and ideally photographed) prior to isolation;
- Complex cavities may require a temporary foundation restoration to enable retainer placement;
- Artificial undercuts may be created by temporary placement of flowable resin composite;
- Anaesthetic (confirm that local or topical anaesthesia has been achieved prior to isolation).

Equipment selection

A wide array of rubber dam materials and equipment is available, from a range of different manufacturers. The purchase and mastery of a small selection of high-quality equipment will bring long-lasting rewards at minimal expense (Figure 4).

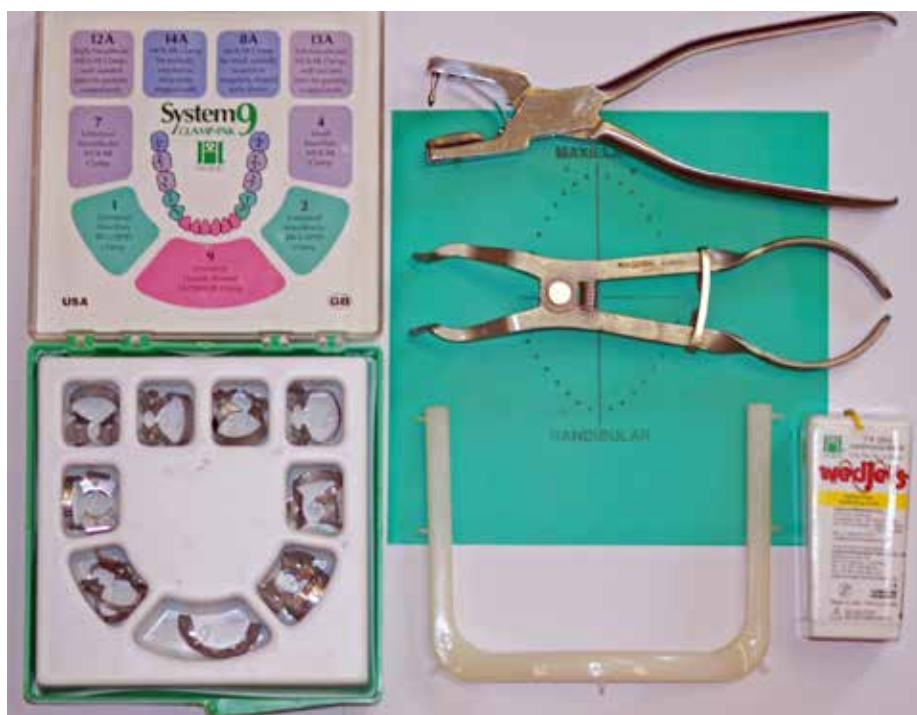


Figure 4. Basic rubber dam kit. Main components (Hygienic System 9, Coltène-Whaledent) 20 years old.

selection and placement include:

- Purchase only high-quality rubber dam retainers to minimize the risk of fracture;
- Retainers should have at least four-point contact to maximize stability and resist rotation;
- Metal retainers are generally considered to be the most effective and long-lasting;
- The authors recommend winged retainers (confusingly wingless retainers are marked with a W);
- For endodontic treatment and for restorative procedures *not* involving proximal surfaces, the retainer is usually placed on the subject tooth;
- For multiple tooth isolation, retainers are placed on a tooth that is distal to the subject tooth, to maximize visual, operative and restorative access;
- Rubber dam retainers are orientated with their bow distally to optimize visual and operative access;
- Molar retainer designs 12A and 13A may be used for most posterior isolation procedures (Figure 7).
- When treating premolars, it is recommended to place the retainer on an adjacent molar, as premolar morphology and premolar retainer

Rubber dam

A wide variety of rubber dams are available and may be selected based on operator preference using selection criteria described in Table 3.

Retainer selection

While the range of rubber dam retainers is vast, mastery of a limited selection will enable excellent isolation in most clinical situations. General guidelines for retainer

| | |
|--------------------|---|
| Size | Rubber dams are generally available in two sizes, 13 x 13 cm and 15 x 15 cm Larger sizes afford more coverage and may be easier to use in most operative procedures |
| Material | Latex (good handling properties/hypersensitivity risk) ¹⁵ Polyolefin (similar properties to latex) ¹⁵ Elastic silicone plastomer (increased flexibility/tear resistance/small dam holes reduce risk of displacement) ¹⁵ |
| Thickness | Range includes thin (0.15 mm), medium (0.2 mm), heavy (0.25 mm), extra heavy (0.3 mm) and special heavy (0.35 mm) Medium thickness is recommended as thin dam is more fragile and likely to tear and thick dam, although offering enhanced retraction, may be difficult to place through interdental contact areas |
| Surface | Where a rubber dam has a dull and a shiny side, it should be orientated so that the dull side faces the occlusal surfaces |
| Flexibility | Flexibility of the dam affects tension on retainers and patient comfort |
| Colour | Contrasting and light-reflecting colours improve visual access Light blue dam is recommended for clinical photography backgrounds |
| Flavoured | Designed to enhance patient acceptance |
| Specialized design | User friendly rubber dam systems may be useful when learning isolation techniques (Figures 5 and 6) |

Table 3. Rubber dam selection criteria.

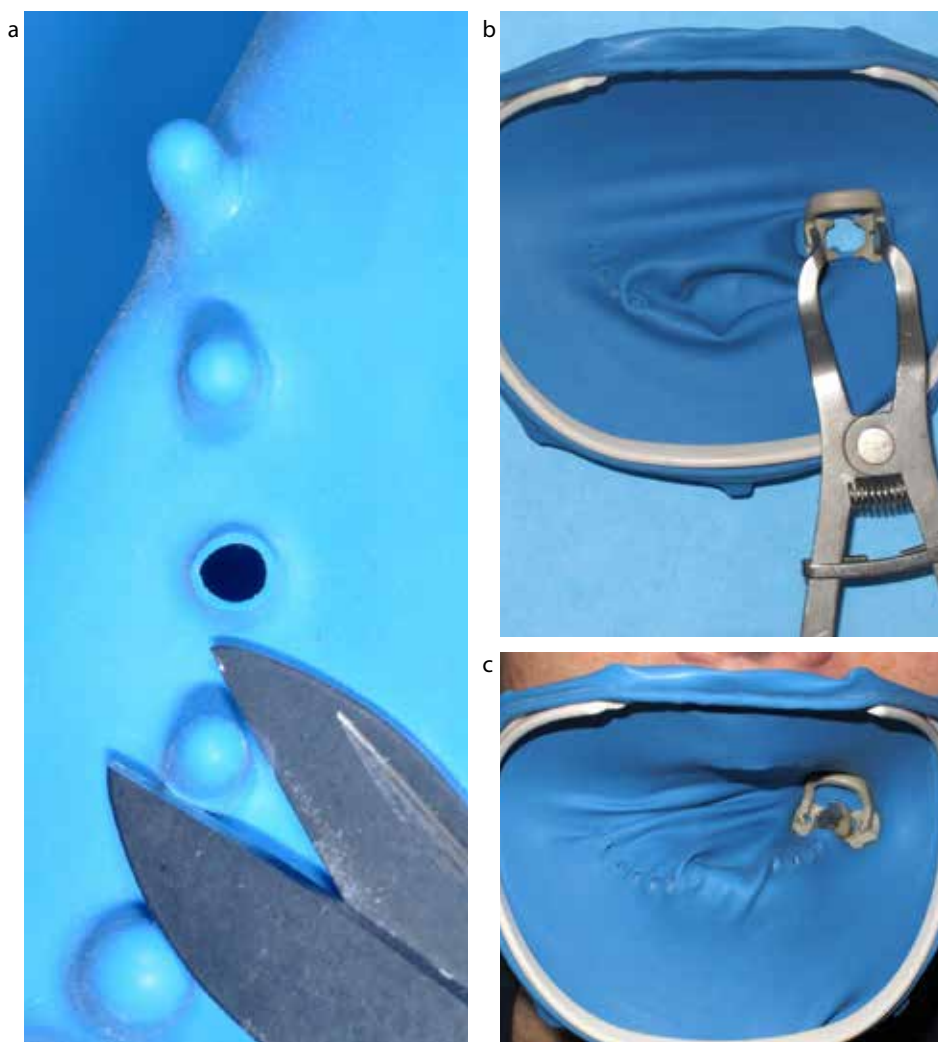


Figure 5. OptiDam™ (Kerr, Bioggio, Switzerland) 3-dimensional shaped dam: **(a)** unique nipple design; **(b)** contoured anatomical frame; **(c)** ease of use/rapid application/patient comfort.



Figure 6. Drydam® (Directa, Upplands Väsby, Sweden) integral face mask and ear loops. Latex with an absorbent lining (patient comfort and reduced allergy). (Image courtesy of Jansie Van Rensburg).



Figure 7. Versatile molar retainers 12A (mandibular right/maxillary left) and 13A (mandibular left/maxillary right) (Hygienic, Coltène-Whaledent).



Figure 8. Dental floss placed around a molar retainer for safe retrieval if retainer fracture or displacement occurs during retainer fit test without rubber dam.

Bioggio, Switzerland) promote user-friendly isolation of broken down, terminal molar teeth and partially erupted teeth and are useful when not using anaesthesia, eg fissure sealants and minimally invasive preventive resin restorations (Figure 9). ■ Double bow ('butterfly') retainers may be used for anterior teeth; they are usually orientated with the concave bow placed palatally, but may be reversed if that improves stability (Figure 10).

As double bow retainers may obstruct anterior restorative procedures, retainers may be placed distally and/or specialized retainers employed (Figure 11).

Rubber dam punch, forceps and frame

The cutting of holes is usually carried out with a rubber dam punch, often with a rotating metal table that allows different-sized holes to be punched. This is a precision instrument that must be well maintained as clean cuts are required to reduce the risk of tearing when the dam is stretched over teeth/rubber dam retainers. The accurate positioning of rubber dam holes presents challenges for the inexperienced user, which may be overcome by using an inked rubber dam stamp or template or by cutting, rather than punching, a specialized dam (OptiDam™ Kerr, Bioggio, Switzerland) (Figure 5). Tips for the use of rubber dam punches, forceps and frames are as follows:

- Traditionally the rubber dam may be

design may limit stability;

- Retainers may be tried in to test their fit. During fit testing, the retainer should

be secured with dental floss to allow safe retrieval in the event of retainer fracture (Figure 8).

- Versatile plastic SoftClamps™ (Kerr,

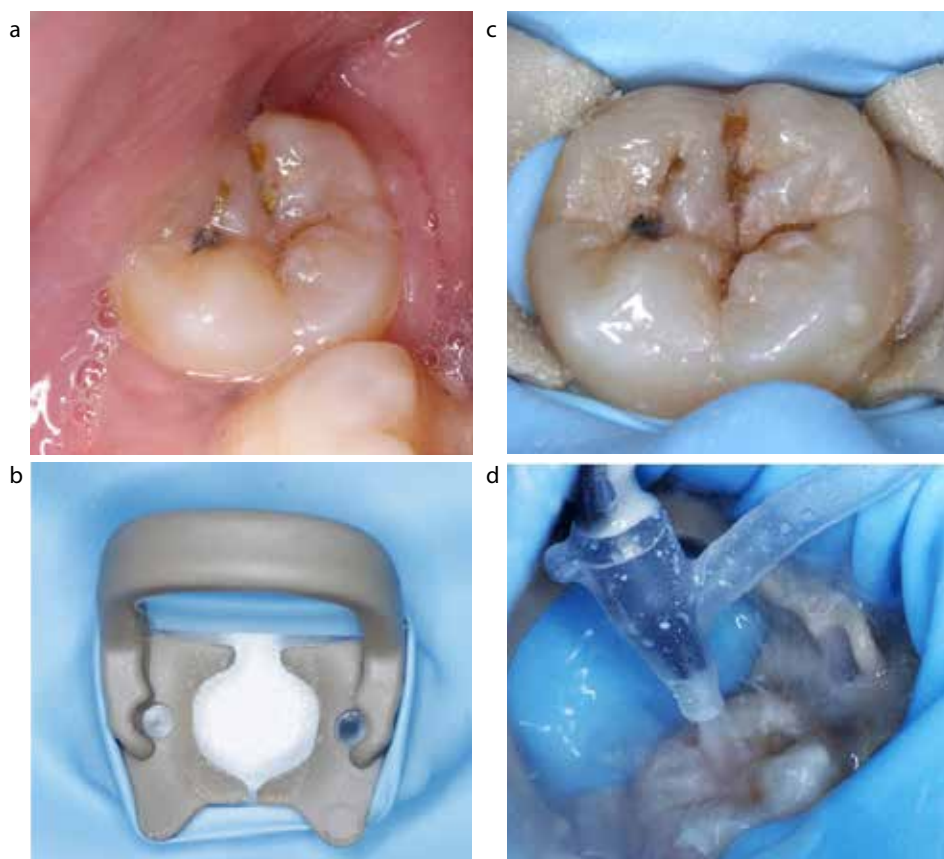


Figure 9. (a–d) Easy isolation of a partially erupted, malpositioned, third permanent molar enables accurate diagnosis and minimally invasive management of an early Class I carious lesion.



Figure 10. Double bow anterior retainers simplify anterior endodontic isolation but may obstruct anterior restorative procedures.

folded and creased or marked to identify the centre and approximate position of the central incisal area (~2.0 cm from the top of the dam to avoid covering the patient's nose);

- However, to maximize respiratory infection control, holes may be repositioned to facilitate nose covering⁴ (Figure 12).⁶
- While it is possible to isolate full

arches or quadrants, for maximum moisture and infection control it is recommended to use the minimum number of dam holes;

- Although punching smaller dam holes will optimize the seal, usually the largest hole may be selected for convenience;
- Once a rubber dam punch becomes worn, extended clinical use may be gained by using second or smaller holes to maintain cutting accuracy;
- While templates are available, freehand hole punching is recommended to suit individual tooth positions;
- Once the first hole is punched, any further holes are placed approximately 3.0–4.0 mm apart, leaving spaces for missing teeth;
- The easiest way to create the holes without ripping the dam is to punch and push the punching tip through the hole;

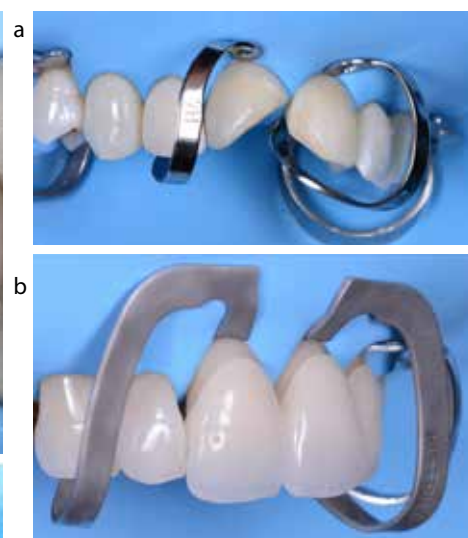


Figure 11. Specialized rubber dam retainers for direct (a) and indirect (b) restorative procedures. (Images courtesy of Dipesh Parmar).

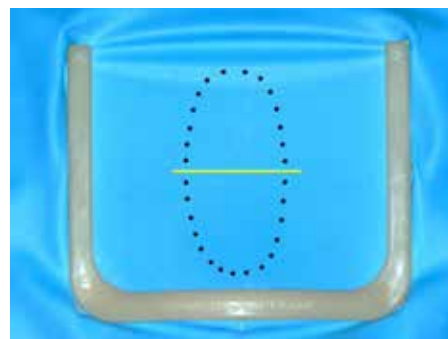


Figure 12. Hole diagram and frame positioning to maximize respiratory isolation.

- Make sure that remnants from previous punching are removed from the hole punch wheel prior to use;
- Lightweight rubber dam forceps are recommended;
- Although the retentive points on metal rubber dam frames are more robust, the authors recommend plastic frames, eg Starlite visi-frame (QED endo, Peterborough, UK) (Figure 12);
- Rubber dam frames may be placed on top of, or beneath, the rubber dam or the dam may be folded over the dam frame to create a well, designed to prevent water flowing off the dam edges (Figure 13);
- The rubber dam tension should be minimized to allow flexibility during placement and use.



Figure 13. A rubber dam folded over the frame to create a fluid-retentive well.



Figure 14. Caulking agent¹⁵ Oraseal™ (Optident, Ilkley, Yorkshire). Expanding hectorite clay material prevents saliva leaking into the operative field and blocks passage of chemicals to the mouth, eg endodontic irrigants and phosphoric acid etchant gel.

| Accessory | Function | Example Brand/Manufacturer |
|---------------------------|--|--|
| Dam stabilizing cord | To prevent dam lifting between contacts | Wedgets® (Latex) (Coltène-Whaledent) |
| Dental floss ligatures | To optimize dam inversion/cervical seal | eg Oral B Pro-Expert (PTFE) |
| Rubber dam napkin | To protect patient's skin, eg hypersensitivity | Ora-Shield® (Coltène-Whaledent) |
| Caulking agent | Optimize dam seal (especially for endodontic procedures) | Oraseal™ (Optident, Ilkley, Yorkshire) (Figure 14) |
| Rubber dam stamp/template | Aids accurate positioning of rubber dam holes | Various |
| Water soluble lubricant | Facilitation of dam placement through contacts | Various |

Table 4. Rubber dam accessories.

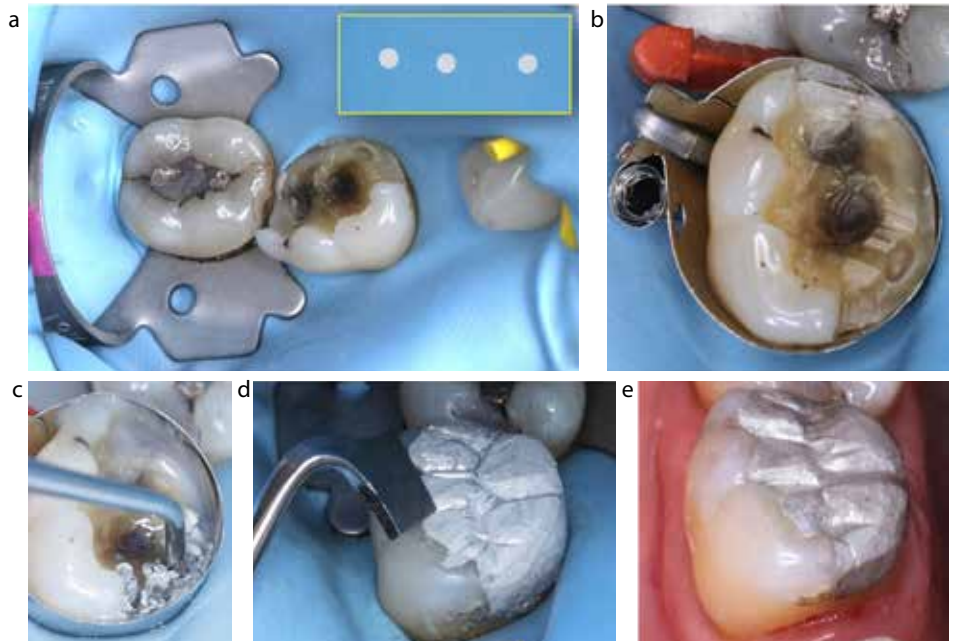


Figure 15. (a) Rubber dam isolation for a bonded amalgam restoration, dam holes spaced to accommodate a missing tooth. (b) Retainer-less AutoMatrix® system assists isolation and does not interfere with the rubber dam. (c) Rubber dam isolation protects patients from uncomfortable excess amalgam particles during placement (and carving). (d) Anatomical carving is completed with rubber dam in place. (e) Minimal adjustment is necessary after rubber dam removal.

Accessory equipment

A wide range of accessories are available to optimize rubber dam isolation, and include the equipment listed in Table 4.

Matrix systems

The use of rubber dam isolation optimizes adhesive procedures and, with experience, may be confidently used for the vast majority of restorative treatments. In conjunction with rubber dam isolation, retainer-less, circumferential matrix systems are recommended, eg SuperMat (Kerr, Bioggio, Switzerland) and AutoMatrix® (DentsplySirona, York, Pennsylvania) (Figure 15 a–e).

These matrices are easy to use, promote better access and result in better

restorative contacts. They also help to retain the rubber dam and the absence of a retainer reduces the risk of interference. These versatile matrices may also be placed on top of a suitable rubber dam retainer, eg when restoring the last tooth in an arch.

Summary

The use of rubber dam isolation optimizes endodontic and restorative procedures and provides a very high level of infection control. The time taken to master rubber dam materials, equipment and clinical

techniques will enhance confidence, improve outcomes and be rewarding for patients and clinicians alike.

Compliance with Ethical Standards

Conflict of Interest: The authors declare that they have no conflict of interest.

Informed Consent: Informed consent was obtained from all individual participants included in the article.

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CPD ANSWERS May 2020

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| 1. A | 6. C |
| 2. C | 7. B |
| 3. C | 8. A |
| 4. B | 9. C |
| 5. B | 10. B |



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