# OptiDam, the new dimensional rubber dam

M. Besek

**Swiss Dental Centre, Centre for modern dentistry, Heinrichstrasse 239, CH-8005 Zurich**

Mario Besek, Dr. med. dent

Cofferdam, a matter and material already quite a few years old. In 1861, Good Year introduced vulcanisation. Already 3 years later it entered the dentistry sector, when a certain Mr Barnum got the idea to use a rubber sheet in order to isolate teeth under treatment. This was the rubber dam's (Cofferdam's) birthing hour. Where the name came from has never been really clear. One theory is the derivation from the Dutch word Coffer, meaning the chambers inside large ships, which could be hermetically sealed in case of leakage, in order to prevent water from penetrating the ship's neuralgic areas. Around the turn of the century, the rubber dam began spreading around Europe, until suction systems stopped its victory procession. Today, the rubber dam seems once more to become appreciated, particularly as inter-oral adhesive techniques have increased application possibilities.

The rubber dam offers manifold possibilities to isolate operational areas. It guarantees germinal isolation, protects patients from aspiration, from contamination with aggressive solutions and materials, protects the practitioner from patient germs and halitosis. An interesting aspect is also the transposition of oral privacy, whereby the patient gets the feeling that his teeth are being treated outside of the oral cavity. With the appropriate material and suitable technology, the operational field can be almost perfectly dried and isolated. These days, aspiration and contamination protection (e.g., during amalgam removal) plays an important forensic part. Due to international increase in dental-coloured restoration and reconstruction, a lot of emphasis is put on adhesive technology. Various studies have proven that dental surfaces

with saliva contamination being prepared for adhesion cannot be adequately coated, causing the adhesive technology to fail. The results are possible retention loss on the one hand, or ugly, discoloured restoration edges due to lack of bonding with the dental surface and increased risk of caries on the other.

Since the introduction of the latex rubber dam in 1864, there has been some thought about how to attach the rubber sheet both in- and outside of the oral cavity. Additional aiding materials such as rubber dam frames and clamps were created and discussions on the form of the rubber sheet were still held at the turn of the century. Until a short time ago, a flat rubber sheet (approx. 18cm x 18cm), mounted on a rectangular metal frame was the norm, whereby the frame's pointy retention parts which could lead to injury in the facial area were used for the attachment of the rubber dam. During the last 10 years, the appearance of various additional forms of the rubber sheet and corresponding frames showed that interest is present, but also, that form and function are not quite satisfactory. Normally the rubber dam, mounted onto the frame, is attached to a tooth with a clamp distally to the operational area. In counter-arguments against rubber dam technology, it is described how the planar-mounted rubber dam reduces free breathing, as a vacuum, caused by the saliva extractor, is produced in the oral cavity, and how high tension on the sheet causes pain in the soft tissue and how rubber dam application leads to limited freedom of action. Additionally, mention is made of how cumbersome the application is and that, due to the tension, very strong steel clamps are required for the attachment to the teeth, which again causes pain or even new defective teeth.

These arguments lead to changes in the form of the rubber sheet and frame. The rubber dam surface area was reduced in size and so were the frames, which, mostly made of plastic, permit smaller and rounder forms and, if integrated into the rubber, can be disposable or, if attached separately, still have pointy tips or cannot afford sufficient hold. In this regard the problem for the end user seemed not to have been satisfactorily solved.

Regarding the clamps or attachment elements, a problem exists with the high tension of the extra-orally mounted rubber dam, as soon as the clamps are attached to the molar area. The required strong hold still leads to the application of traumatising clamps, as not only plastic clamps but also other aiding material continue to lose retention on teeth.

The application of the rubber dam leads to a certain helplessness, as the advantages are visible, but the varieties of techniques confuse the practitioner. Two rubber dam application techniques have asserted themselves. Placement of the selected clamp onto the most distal tooth, subsequent four-handed attachment of the rubber dam with the help of an assistant and finally the mounting of the frame. This technique leads to some effort in handling the unmounted rubber dam, although or maybe because the practitioner carries out the application together with the assistant. The second technique involves the punching of the appropriate rubber dam areas with a punch and the mounting on the frame. Subsequently, a suitable rubber dam clamp is inserted in the hole and is mounted together with rubber dam and frame distally to the row of teeth under treatment (Fig. 1). This method has established itself, as the application represents simplified handling, whereby the number of hands working in the oral cavity is reduced. Various handling deficiencies of the system and integrated error sources have increased optimisation speed. As a system, OptiDam represents a clear improvement.

Firstly, OptiDam captivates through its unusual, pre-formed 3-D design. The consideration to create a 3-D rubber dam stems from the increased pre-tension. The path from the perioral level to the most distal molars is compensated. Which means that, at least theoretically, OptiDam could do without molar clamps, as it lies passively in the oral cavity. This has forensic consequences and is of preventative nature. While a strong gripping clamp is required in the case of high pre-tension, this can avoid injury to hard and soft tissue. Especially in adolescents, who perhaps show de-mineralised zones in the tooth neck area, the pressure of such clamps could cause breaking of the enamel structure and therefore irreversible damage. Negative consequences

could also occur in older people with tooth neck defects or crown re-constructions. The tension-free OptiDam helps to avoid this. The asymmetrical, 3-D form of the OptiDam posterior is intentional. More free space is provided in the quadrant to be treated, i.e. the rubber dam is moved less by unintended manipulation and “displacement” is therefore avoided (Fig. 2). Operative instruments such as hand pieces are also provided with more space, which permits safe instrument control. Sufficient room should be available for saliva suction by the assistant or a passive, inserted saliva ejector (Fig. 3), so counter-laterally it is undesirable that the rubber dam takes over too much space in the oral cavity. At the same time an opening in the corner of the mouth is created to avoid an unpleasant vacuum caused by the saliva ejector and to allow the patient to breathe orally. This is not only possible due to the asymmetrical 3-D design, but also due to the adjusted rubber dam frame. The perioral rim of the OptiDam is formed ovally along the lines of the mouth opening and the frame is appropriately constructed. Seen from the front, the frame is also designed ovally on the cross-line level in order to provide the practitioner with optimal handling freedom while the round form provides the patients with more comfort (Fig. 4). However, the frame also follows the 3-D facial contours on the sagittal level. This, in connection with the tension-free rubber dam, leads to less pressure on the lips, which are often pinched between teeth and rubber dam and can be painful to the patient in the long run. The opening of the frame in the nose area was deliberately designed to allow nasal breathing. For attachment of the OptiDam to the frame, spiky thorns and extensions on the frames were replaced with the insertion of a profile, which supports the OptiDam's integrated edge bead. This also eliminated danger of injury. During treatment, this edge bead design also relieves the collection of liquids, which would normally have been spilt onto the patient in a moment of carelessness. This is especially relevant when working with aggressive solutions such as sodium hypochloride or, in case of amalgam intolerance, when drilling dust needs to be carefully collected. The asymmetrical design for the anterior section was abolished for tension-free premolar areas. Emphasis is on keeping the lips away from the dental surface

and in order to ensure optimal, counter-lateral aesthetics, the OptiDam anterior was designed symmetrically (Fig. 5).

One of the main reasons for application failure of rubber dams is inadequate punching of the holes. Even correct placement of the afterwards three-dimensionally mounted rubber dam is bothersome. If the distance between the holes is too small, the papilla appears or saliva penetrates. If the holes are too small, placement over the tooth is hampered, if the holes are too large, saliva penetrates or agents penetrate the sulcus. The distance can be predetermined with a template, but this signifies further effort. If the holes are incorrectly punched, the rubber dam tears. For easier and reliable punching of the rubber dam, OptiDam has preformed "nipples" of the right size at the right places. Punching is carried out by simply cutting the nipples. Cutting forms an inverted hole oriented to the sulcus. Depending on at what height the nipples were cut, the rubber dam more or less slides into the sulcus. The advantages are easier displacement of the gingiva, a larger bearing surface for the valve around the tooth and, especially in the anterior area, more space for hands-free modelling. Sharp scissors can achieve inexpensive, safe punching. A further point for successful rubber dam application is slippage or non-slippage of the rubber dam respectively. Generally, the surface of the latex rubber dam is coated. This is done for two reasons: during storage the individual rubber sheets in the packaging should not stick to one another and should be easily removable and secondly, although the rubber dam needs certain slippage it should retain sufficient friction to enclose the tooth tightly. Slippage also involves reduced contact friction if, for example, latex gloves or the angle touch the rubber dam during treatment. So-called "sticking" is undesired and would impair manipulation safety. In most cases, talcum powder is used, which is noticeable as fine dust on the surface. However, this powder has proven to be increasingly disadvantageous, as the powder "transporting" the latex proteins can provoke allergies even from distance, but otherwise latex incompatibility exists only to a small extent. Other procedures evade this surface powder, which alleviates this problem almost completely and increases the good grip on the rubber dam. OptiDam's surface treatment was optimal.

As is generally known, yellow's complementary colour is blue. As the basic dental colour is yellowish-red, blue seems obvious as background colour. An objective colour determination is certainly impossible after placement of the rubber dam due to drying of the teeth, but a blue background permits a more differentiated assessment, especially during anterior tooth restoration, if the so-called layering technique is applied. Apart from a more objective colour perception, blue is relaxing to the eye and increases contrast perception which is important especially during very detailed work (Fig. 6).

Application of OptiDam anterior is remarkably easy. After cutting holes in desired dimensions, the rubber dam is mounted on the frame and usually placed over the teeth in counter-lateral, symmetrical position. The correct distance of the holes and the slippage in the moist environment relieve the positioning of the interdental septa with dental floss (Fig. 7). Fixation in the premolar area does not necessarily require a clamp. Dental floss ligation or an adequate aiding material might serve as useful (Fig. 5). If the rubber edges around the holes do not slip into the sulcus unaided, an air-syringe can be applied. The indicated, preformed vestibulum assists in the placement of the rubber dam between lips and teeth. The so-called adhesive technique is applied in complex cases such as defective dental positioning or varying gingiva levels. Here, the nipples of the rubber dam are not cut, but slit with scissors along the dental row. With a tissue adhesive (Histoacryl®), the rubber dam is buccally and orally glued to the gingiva (Fig. 8). After treatment, the rubber dam can be removed without effort or injury to the soft tissue. In order to slice the rubber dam at the correct places, the nipples are used as a guide (Fig. 9). In order to ensure an even fit of the rubber dam to the gingiva, the slit is carried out buccally to the nipples. The tension-free OptiDam is of advantage here, as the tissue adhesive has only limited adhesion. Therefore the rubber dam's scope of application entails not just individual restoration but also more complex restoration techniques. OptiDam anterior has the Up and Down version, i.e. precise nipple positioning for the upper as well as the lower jaw. The rubber dam can therefore be applied to the upper and lower jaw simultaneously. This is almost impossible with conventional rubber dam

systems, whereas OptiDam anterior creates new dimensions, especially in the professional bleaching sector. An optimal gingiva protection is essential, especially during Power Bleaching, where peroxide concentrations of up to 40% are used. Simultaneous placing of the rubber dam in both jaws reduces the total treatment time and supports a more economical operation. The extended isolation of clinical tooth crowns due to inverted holes enables bleaching of the tooth neck region, which until now has seemed impossible.

OptiDam posterior application does not essentially differ from conventional techniques, but is considerably easier due to the mentioned properties (Fig. 10). If a clamp is used, we recommend (as with all rubber dam applications) that the hole sufficiently pre-stretched prior to insertion of the clamp into the rubber dam, so that the clamp can be passively inserted. Here too, the application scope entails individual dental restoration as well as more complex treatment methods, such as adhesive insertion of non-metal crown-bridgework reconstruction, whereby the rubber dam is also slit analogue to the anterior area (Fig. 11).

A patient-oriented design and simplified handling enable a more pleasant and safer application for even the most hackneyed rubber dam practitioner, whereas beginners in rubber dam techniques are relieved of certain reservations regarding handling difficulties. Although revolutions in dentistry occur less and less, the evolution of the rubber dam seems to have reached a new zenith with OptiDam, which has made a valuable contribution to dentistry.

Assmussen E, Peutzfeld A: The influence of relative humidity on the effect of dentin bonding systems. J Adhesive Dent 3: 123-127 (2001)

Champion M.A, Kugel G, Gruskowski C: Evaluation of a new intraoral isolation device. Operative dentistry 16, 181-185 (1991)

Cochran Michael A, Miller Chris H, Sheldrake Margie A: The efficacy of the rubber dam as a barrier to the spread of microorganism during dental treatment. JADA 119, 141-144 (1989)

Christensen Gordon J: Using rubber dams to boost quality. JADA 125, 81-82 (1994)

Dodes J.E.: the amalgam controversy. An evidence based analysis. J Am Dent Assoc 132: 348-356 (2001)