Case Report

Treatment of Digital Mucous Cysts with a Single-Layer Integra® Dermal Regeneration Template: A Case Series

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ABSTRACT

Distal mucous cysts (DMCs) occur in the distal interphalangeal finger joints or the interphalangeal thumb joints. Current treatment regimens include surgical cyst excision, which may involve skin flap elevation. More recent approaches include osteophytectomy or joint capsule removal (with or without cyst excision). In the present case series, the authors excised five DMCs with thinned skin, conducted osteophytectomy when necessary, and then covered the wounds with the Integra® Dermal Regeneration Template-Single Layer (IDRT-SL) system. There were no postoperative complications, including limitation or deterioration in the joints' range of motion, and recurrence was not detected. The cosmetic outcomes were excellent. This may reflect the ability of IDRT-SL to facilitate untrammelled epithelialization and reduce myofibroblast activity, thereby limiting wound contracture. While IDRT-SL is relatively costly, it is considered cost-effective due to the length of the procedure (15 min), low recurrence rates, fast healing, and favorable appearance. Therefore, simple excision and coverage with IDRT-SL may be a beneficial treatment option for DMCs.

Key words : artificial dermis, digital mucous cyst, Integra Dermal Regeneration Template

Introduction

Digital mucous cysts (DMCs) are painless, benign, firm, round/oval, fluid-filled cysts that generally occur in middle-aged to elderly people on the distal interphalangeal finger joints or the interphalangeal thumb joints. While the etiology of DMCs has not been definitively established, two main types of DMCs have been described. The first is the myxomatous-type DMC, which is caused by fibroblast overproduction of mucus that accumulates in the subepidermal space and produces a shallowly seated cyst^{1, 2)}. The second is the ganglion-type DMC, in which osteoarthritis or osteophytes induced by degenerative joint diseases cause outpouching of the synovial lining or herniation of the tendon or capsule surrounding the joint. In such cases, the cysts are often connected to a nearby joint by a communicating pedicle¹⁾.

Generalized treatment regimens for DMCs have not yet been established. Surgical excision of the cyst is the most common treatment currently used³⁻¹⁰⁾; other treatment strategies include aspiration, cryotherapy, steroid injections, and radiotherapy³⁾.

Surgical excision requires elevation of a skin flap. More recent methods of surgical excision include osteophytectomy or joint capsule removal with or without excision. These approaches have been associated with low recurrence rates^{11, 12)}.

The Integra® Dermal Regeneration Template (IDRT) is a two-layer skin regeneration system. The outer layer is made of a thin silicone film that acts as the epidermis, whereas the inner layer consists of cross-linked fibers that provide a scaffold for regenerating dermal skin cells. Once dermal skin has regenerated, the outer layer is removed and replaced with a thin epidermal skin graft. The inner layer of the IDRT can also be used independently (IDRT-single layer [IDRT-SL]) for well-vascularized full-thickness skin defects, because this one-step procedure is associated with good functional and esthetic outcomes. This reflects the ability of the inner layer to inhibit myofibroblast formation and activity, which prevents wound contraction and allows the neodermis to regenerate with limited scarring¹³⁻¹⁵⁾.

We present five cases of DMCs that underwent surgical excision followed by closure with IDRT-SL which yielded excellent outcomes.

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Received: 13, August 2021 / Accepted: 9, December 2021

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Table 1. Patient details

Patient No.	Sex	Age	Digit	Surgical time	osteophytectomy	Follow-up period	Recurrence	Postoperative complications
1	Female	68	Little (L)	17 min	+	8 months	None	None
2	Male	54	Index (L)	26 min	+	7 months	None	None
3	Male	47	Index (R)	20 min	—	6 months	None	None
4	Male	67	Index (R)	26 min	+	7 months	None	None
5	Male	78	Ring (L)	15 min	—	8 months	None	None

L, left; R, right.

Patients and surgical method

All patients who underwent surgical excision of a DMC followed by closure with IDRT-SL between 2019 and 2020 at Jichi Medical University (Tochigi, Japan) were included in this study. All surgeries were performed under digital nerve block. The cysts and thinned skin covering the cysts were excised. Osteophytes were excised if they were readily manipulated with tweezers or other tools after cyst excision. The skin defects were covered with one to three layers of IDRT-SL, which were sutured to the wound edges with nylon thread. Wounds were then subjected to compression fixation with a non-sticky gauze (Sofratulle Gauze Dressing, Teika Pharmaceutical Co., Ltd.) for one week. The thread and compressive dressing were subsequently removed, and the wound was treated conservatively with an ointment containing gentamicin sulfate. At this time, patients were asked to start self-flexion movement of the joints. The patients were re-evaluated during follow-up visits. Surgical outcomes, recurrences, postoperative complications (infection, hematoma, and range-of-joint-motion limitation/deterioration), and appearance of the affected area (especially nail deformities) during follow-up visits were recorded and assessed retrospectively.

Results

The case series comprised five digits from five patients. Four patients were male, with an average age of 62.8 (range, 47–78) years. The cyst was on the index finger in three cases, the ring finger in one case, and the little finger in one case (Table 1). The patients were followed-up for a mean of 7.2 (6.0–8.0) months. Postoperative recurrence, infection, hematoma, and range-of-joint-motion limitation or deterioration were not observed in any case. No nail deformities were observed, and the appearance of the resulting scar was excellent. Images of the affected joints prior to and immediately after the surgery and at postoperative months 6–7 for two cases are shown in Fig. 1 and 2.

Discussion

Until the 1970s, it was unknown whether osteophytes are associated with DMCs, and if osteophytes play an etiological role. Consequently, the previous treatment of choice consisted of aspiration, steroid injection, or cyst resection³⁾. However, the recurrence rate with these methods was high. The recurrence rate after aspiration and injection is greater than 50%, and is greater than 25% with simple cyst resection^{5, 6, 8, 16)}. Eventually, osteophytectomy or joint capsule removal with or without cyst excision, which sometimes involved skin flap elevation, became the predominant approach^{1, 7)}. The recurrence rate with this approach is low, with an almost 0% recurrence rate^{3, 5, 6, 8, 12)}. One study suggested that raising and re-siting a skin flap effectively disrupts the stalk, leading to good outcomes for finger DMCs¹⁷⁾. In our case series, cysts were excised with the thinned skin over the cyst whenever possible, and osteophytectomy was performed only when osteophytes in the wound bed could be manipulated via instruments. The wound was subsequently covered with an IDRT-SL. This approach had no recurrence and had excellent cosmetic outcomes. Moreover, this is the first study to report the use of an artificial dermis for distal mucous cysts. We speculate that these good outcomes were partly due to the IDRT-SL-inducing adhesions that covered the pedicle of the cyst running from the joint capsule. This notion is supported by several reports showing that the three-dimensional matrix of the artificial dermis can induce fistula closure by flexibly covering the leakage point. The matrix also promotes local dermal regeneration by improving vascular growth and attracting cells to the sheet¹⁸⁾.

The advantage of IDRT-SL is that it has half the thickness of previous products and lacks the silicone layer in standard IDRT. This means that epithelialization from the wound edges can progress at the usual speed. Furthermore, postoperative wound care is much easier because silicone removal can be skipped. The IDRT-SL matrix also inhibits myofibroblast activity and thereby limits the occurrence of wound contractures¹³⁾. Conversely, Pelnac (Gunze Corp., Osaka, Japan) is an alternative that has neoformed tissue architecture

Fig. 1. Surgical outcome of a distal mucous cyst on the left index finger of a 68-year-old woman.

- A: X-ray image of the index finger before treatment (osteophytes are encircled).
- B: Preoperative appearance.
- C: Appearance immediately after the cyst, the thinned skin covering the cyst, and an osteophyte were excised and after IDRT-SL was sutured to the wound edge.
- D: Appearance after the wound was covered with a non-sticky gauze dressing.
- E: Appearance seven months after surgery.
- F: The excised osteophyte.

Fig. 2. Surgical outcome of a distal mucous cyst on the left little finger of a 54-year-old man.

- A: Preoperative appearance.
- B: Appearance immediately after the cyst, the thinned skin covering the cyst, and an osteophyte were excised and after IDRT-SL was sutured to the wound edge.
- C: Appearance six months after cyst excision.

closer to the true skin physiology, which allows for rapid neoangiogenesis and tissue regeneration¹⁹. One study suggested that Pelnac should be the first choice in cases where shortening the treatment period is important²⁰. However,

another study reported no differences in the treatment period between Integra and Pelnac use; however, there was an important difference in terms of wound contraction, which was more marked in injuries treated with Pelnac¹⁹. To date, IDRT-

SL has been used together with skin grafts or negative-pressure wound therapy for burns or after the excision of skin tumors^{14, 12-25}. Our case series suggests that IDRT-SL can also be used for relatively small skin defects: it promotes good epithelialization, is not associated with recurrence or an increased risk of infection or hematoma, and results in excellent cosmetic (including nail shape) and functional outcomes. Moreover, the operations were simple and could be performed quickly (approximately 15 min). A disadvantage of IDRT-SL is that, as of March 2021, one 5 × 5-cm layer costs 11,300 yen (about US \$102). However, overall cost is likely to reduce considering the short duration, lack of postoperative recurrence, and lack of deformities that arise when flaps or skin grafts are used.

Conclusions

An optimal treatment strategy for DMCs has not yet been established. The present case series showed that excising the cyst and its thinned skin covering while subsequently covering the skin defect with IDRT-SL led to excellent cosmetic and functional outcomes, a low recurrence rate, and few postoperative complications, thus allowing patients to quickly resume normal lives.

Acknowledgments

This case report conforms to the Declaration of Helsinki.

Sources of funding

There are no financial disclosures to be made.

Conflicts of interest

None declared.

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