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Direct Class I Composite Restoration of a Deep Occlusal Carious Lesion A Conservative Approach – Case Report

Hashir Ather 

ABSTRACT

In adhesive and restorative dentistry, advancements introduced by mankind has evolved management of carious lesions. In this case report, one will find a brief overview of management of deep occlusal carious lesion in a permanent mandibular molar using a direct Class I composite restoration.

A 25-year-old patient reported with pain in the lower left posterior mandibular region. On clinical examination, a deep occlusal carious lesion was found on tooth #37. No pulp involvement was present. On radiographic examination, it was confirmed that the lesion is only extended to dentin and has not involved pulp. No periapical pathology was confirmed. For moisture control, rubber dam was placed, followed by excavation of caries with spoon excavator. This was done to preserve remaining tooth structure. For direct restoration, composite resin was used. This was done with incremental layering and light curing. Post-operative period indicated that patient has complete symptom resolution at follow up of one week and one month.

This case highlights the importance of early diagnosis, evaluation on clinical and radiographic basis, and use of restorative techniques for preservation of tooth to a great extent. Composite restoration is a successful and minimally invasive technique for managing deep occlusal carious lesions.¹ This has revolutionized the field of restorative dentistry in a good way.

Keywords: Deep occlusal caries, Direct class I composite restoration, Selective caries excavation, Rubber dam isolation, Incremental composite layering

Introduction

Dental caries affects all age groups worldwide as it is one of the most prevalent chronic diseases. A posterior tooth having deep occlusal caries is challenging, in terms of being restored due to its extent being close to the pulp, which increases chances of pulp exposure.² Modern restorative dentistry believes in restoring tooth function and aesthetics, along with maintaining pulp vitality.³ Minimal invasion and maximal preservation of tooth structure is the top priority.

Evolution of adhesive and composite resin technology has modified the treatment of carious lesions. Composite restorations, when applied correctly, provides efficiency in terms of aesthetics, bonding capabilities and reinforcement of remaining tooth structure.⁴ Direct class I composite restoration treats occlusal caries by serving as a minimally invasive approach, even if the lesion is deep, without pulpal involvement.

For a better treatment, it is mandatory to make an accurate diagnosis. This can only be achieved with the help of clinical examination and radiographs. In case of restorative procedures, a successful treatment is only

possible, if required steps are taken accordingly.⁵ For composite restoration, a proper isolation is required. This can only be done by use of rubber dam. Rubber dam aids in proper isolation, increasing success rate of the composite restoration. Along with isolation, incremental composite placement is also mandatory for the restoration to achieve success.⁶

The main aim of this case report is to highlight the restoration of a deep occlusal carious lesion using a direct class I composite restoration. Clinical decision making and technical steps are elaborated to enlighten with knowledge regarding such treatment for better understanding.

Case Presentation

A 25-year-old female patient presented with a chief complaint of intermittent pain in the lower left posterior region. The pain started for two weeks. The pain was aggravated by chewing. The patient was referred to the department of operative dentistry. On examination, a carious lesion was observed. A cold test was done to check sensitivity. However, sensitivity was not observed, excluding the chances of non-reversible pulpitis or pulpal exposure.

Methods

This case report was conducted and documented after obtaining the patient's written informed consent for both treatment and publication, including the use of clinical images. The report adheres to the SCARE 2025 guidelines.⁵ Institutional policies were followed, and no formal ethical approval was required for a single-patient case report. An institutional exemption/waiver for ethics approval was obtained in accordance with local policy for individual case studies.

Clinical Examination

On intraoral examination, several observations were made. A visual inspection was done, which ensured that cavitation was noted on tooth #37. On percussion and palpation, it was revealed that the tooth was asymptomatic and there were no signs of swelling or sinus tract. A periodontal examination was also done. On probing it was observed that periodontal probing depths were within normal limits.

Radiographic Examination

A radiographic examination was done to confirm the diagnosis. A periapical radiograph of the region demonstrated that a radiolucent lesion is present near to pulp chamber of tooth #37. The periodontal ligament space appeared normal, thereby excluding and periodontal disease. No periapical pathology was evident as well (Figure 1).

Data availability statement: All relevant data are included within this manuscript. Additional data or materials are available from the corresponding author upon reasonable request.

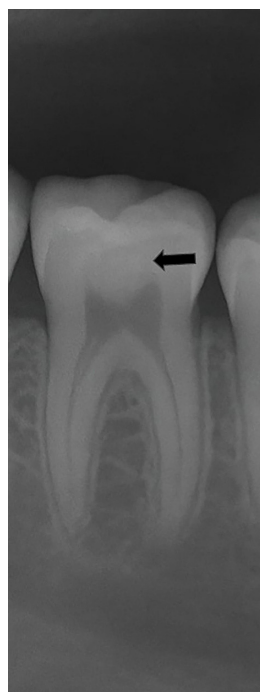


Fig 1 | Pre op x ray. Arrow showing radiolucency, indicating class one lesion around tooth #37

Diagnostic Findings and Clinical Assessment

Clinical examination revealed a **class I on tooth #37 (FDI) / #18 (Universal)**. The tooth was **vital**, with no history of spontaneous or nocturnal pain, swelling, or sinus tract formation. Adjacent and opposing teeth were sound and asymptomatic.

Pulp Sensibility Tests

Pulp Sensibility Testing was performed using thermal and electric stimuli to assess neural responsiveness. The tooth exhibited a normal response profile without prolonged pain, lingering sensitivity, or signs suggestive of pulpal inflammation. Findings supported a diagnosis consistent with normal pulp and absence of apical pathosis per AAE 2022 terminology.

Thermal and electric sensibility tests were interpreted collectively, in accordance with AAE 2022 diagnostic standards, recognizing that no single test alone—including a negative or positive cold response—can confirm or exclude pulpal disease. The combination of a brief, non-lingering cold response, EPT values comparable to the control tooth, and absence of percussion

or palpation sensitivity supported the diagnosis of normal pulp prior to restoration.

Periodontal Evaluation

Diagnostic Interpretation

The combined findings indicated that tooth #37 had a vital and normally responsive pulp with no evidence of periapical or periodontal pathology. The cold test elicited a brief, non-lingering response, consistent with normal pulp function or reversible pulpitis. The diagnosis was based on the comprehensive evaluation of the patient's symptoms, thermal and electric sensibility tests, radiographic appearance, and periodontal status.

Final Diagnosis (AAE 2022 terminology):

- Pulpal diagnosis: Normal pulp
- Periapical diagnosis: Normal apical tissues

Treatment plan

For a better treatment, a conservative approach was planned. This included restoring tooth with direct class I composite restoration. The treatment aimed to remove caries completely, along with preserving pulp and functional restoration of occlusal surface.

The patient was informed regarding the treatment and an informed consent was taken from the patient to ensure that patient agrees well for initiation of the treatment.

Operative Procedure

The restorative procedure was performed under local anesthesia, administered via an inferior alveolar nerve block using 2% lidocaine with 1:100,000 epinephrine. Following anesthesia, tooth #37 was isolated with a medium-gauge non-latex rubber dam secured with a winged clamp to establish strict moisture control and enhance visibility of the operative field.

Conservative occlusal access was gained using a high-speed diamond bur under continuous water coolant. Selective caries removal was performed until firm dentin was achieved, guided by tactile hardness, color, and surface dryness. A caries-detecting dye was utilized to verify the complete removal of infected dentin. No liner or base was placed, consistent with contemporary adhesive dentistry recommendations, which support direct sealing of affected dentin with universal adhesive systems in deep lesions to maintain pulpal vitality and limit microleakage (Table 1).

Table 1 | Pulp sensibility tests for tooth #37

Test	Stimulus & Method	Response	Latency (s)	Duration (s)	EPT Reading*	Interpretation
Cold Test	Endo-Ice (1,1,1,2-tetrafluoroethane) on cotton pellet applied to middle third of buccal surface	Moderate, brief response	2	<1	—	Normal pulp response
Electric Pulp Test (EPT)	Analytic Technology Pulp Tester (lip clip and conducting medium)	Positive at 41/80 (control tooth #36: 39/80)	—	—	41	Normal pulp vitality
Percussion	Tapping vertically with mirror handle	No tenderness	—	—	—	Negative
Palpation	Buccal and lingual mucosa over root apices	No tenderness	—	—	—	Negative

*EPT values expressed on a 0–80 scale.

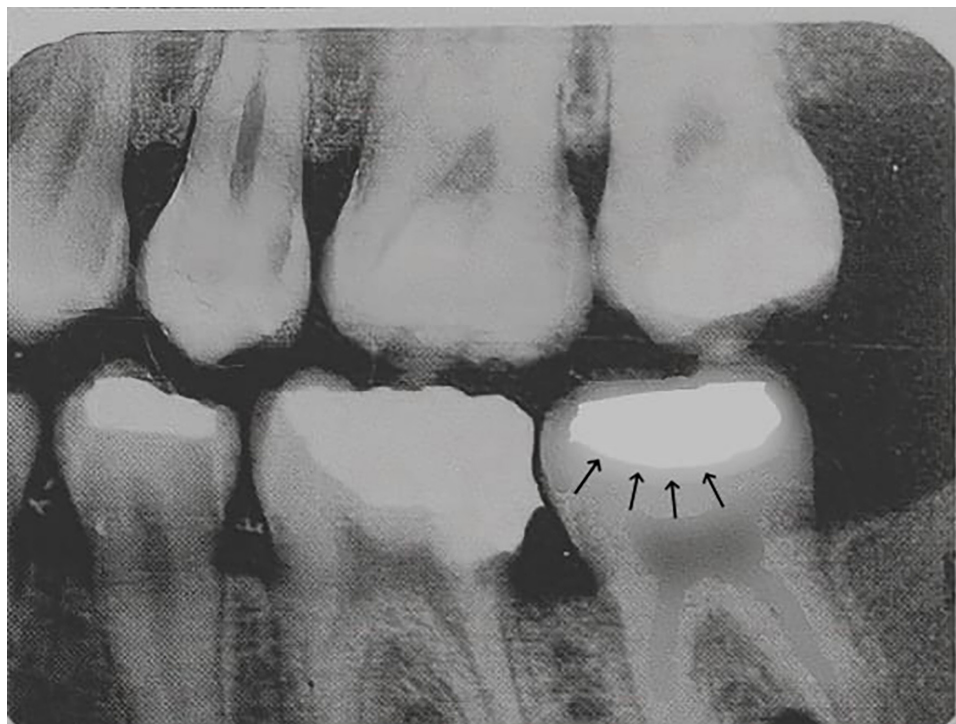


Fig 2 | Pre op Bitewing. Arrows indicating carious lesion on tooth #37



Fig 3 | Rubber dam isolation on tooth#37

A conservative Class I cavity was prepared, preserving maximum sound enamel and dentin to optimize tooth structure and enhance mechanical retention. The prepared cavity was etched with 37% phosphoric acid for 15 seconds, rinsed, and gently air-dried. A universal adhesive was applied to the etched surfaces, air-thinned, and polymerized for 20 seconds using an LED curing unit with an output of approximately 1200 mW/cm² (wavelength 430–490 nm), positioned at an appropriate clinical distance (Figure 2).

A nanohybrid resin composite was placed incrementally, with each layer light-cured for 20 seconds to

Table 2 | Periodontal evaluation of tooth #37

Parameter	Findings
Probing Depths	Within 2–3 mm circumferentially
Bleeding on Probing	Absent
Mobility	Grade 0 (physiologic only)
Furcation Involvement	None detected
Periodontal Diagnosis	Clinically healthy periodontium

Table 3 | Summary table supporting the final diagnosis by consolidating the patient's symptom history and clinical test responses in accordance with AAE 2022 diagnostic criteria

Symptom Parameter	Findings	Interpretation (AAE 2022)
Spontaneous pain	Absent	Consistent with normal pulp
Provoked pain (cold)	Brief, non-lingering	Normal pulp response
Lingering pain	Absent	Rules out symptomatic irreversible pulpitis
Nocturnal pain	Absent	Supports normal pulp
Biting/percussion sensitivity	None	Normal apical tissues

reduce polymerization shrinkage and ensure optimal adaptation. The occlusal morphology was sculpted to replicate the natural anatomy of tooth #37 (Figure 3; Table 2).

Finishing and polishing were performed using fine diamond burs followed by composite polishing discs and silicone points to achieve a smooth and anatomically appropriate restorative surface. Occlusion was assessed using articulating paper, and minor adjustments were made to eliminate high contact points.

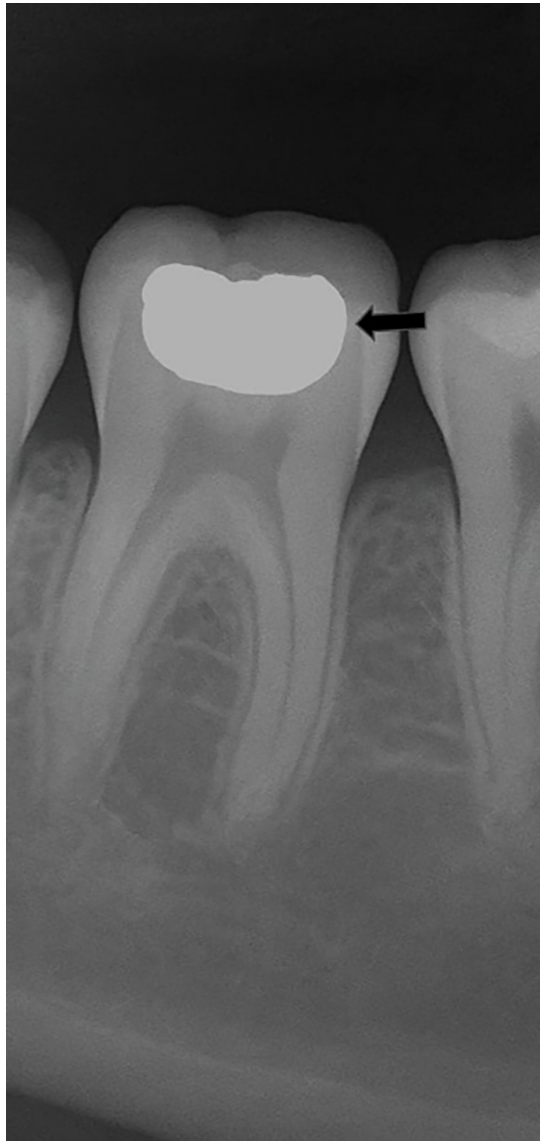


Fig 4 | Post op x ray. Arrow indicating direct Class I composite restoration of tooth #37

A postoperative radiograph confirmed proper restoration placement without voids or overhangs. Clinically, the restoration exhibited intact marginal integrity with no explorer catches, and the patient reported no postoperative sensitivity, indicating a satisfactory functional and esthetic outcome (Table 3).

Follow Up

The patient was recalled after one week, one month, and six months for clinical and radiographic evaluation. The restoration remained intact, maintaining occlusal anatomy. No postoperative sensitivity or food impaction was reported. A periapical radiograph at six months confirmed absence of secondary caries, marginal leakage, or periapical changes. The restoration continued to be esthetically satisfactory and functionally stable.

While these short-term results are favorable, they represent an early observation period. Longer follow-up (12 months and beyond) is planned to evaluate marginal integrity, surface wear, and pulp vitality over time.

Discussion

Managing deep occlusal caries is not easy. It can only be done efficiently by balancing between thorough debridement and pulp preservation. This case was managed successfully by creating cavity design of class I origin, along with selectively removing caries. This allowed for successful restoration without compromising the pulp (Figure 4).

Biological Considerations

In restorative procedures, maintaining pulpal health is of great significance. Studies proved that protection of pulpal tissue and creation of room for remineralization is achievable. This is done by preserving a thin layer of affected dentin near the pulp.

In case of aggressive over overzealous removal of caries, chances of pulpal exposure may prevail. This in turn necessitates endodontic therapy. The clinical and radiographic findings in this case concluded that selective caries removal is necessary for preserving tooth vitality (Table 4).

Table 4 | Follow up table according to USPHS^a and ICDAS^b Criteria

Time Point	Baseline Caries Status (ICDAS)	Marginal Adaptation (USPHS)	Anatomic Form (USPHS)	Surface Roughness (USPHS)	Marginal Discoloration (USPHS)	Post-operative Sensitivity (USPHS)	Secondary Caries (USPHS)	Radiographic Findings	Interpretation / Outcome
Baseline (Pre-op)	ICDAS 5 – Active dentinal lesion approaching pulp	—	—	—	—	—	—	Radiolucency beneath occlusal enamel; no periapical changes	Deep active lesion; pulp vital prior to intervention
1 week	—	Alpha – continuous margin	Alpha – original contour preserved	Alpha – smooth surface	Alpha – no discoloration	Alpha – none	Alpha – none	Not indicated (early recall)	Excellent immediate restoration; tooth vital
1 month	—	Alpha – intact margins	Alpha – normal anatomy	Alpha – smooth	Alpha – none	Alpha – none	Alpha – none	No marginal gap or recurrent caries	Stable restoration; no symptoms; healthy pulp
6 months	—	Alpha – continuous margin, no gap	Alpha – occlusal form intact	Alpha – polished surface retained	Alpha – no staining	Alpha – none	Alpha – none	Normal lamina dura and PDL; no radiolucency	Restoration intact; pulp vitality maintained; 12-month follow-up planned

USPHS Criteria: Alpha = ideal; Bravo = minor deviation; Charlie = clinically unacceptable.

^aUSPHS criteria (Alpha rating): Indicates the optimal score—no defects, no discoloration, no sensitivity, intact margins, and no secondary caries.

^bICDAS: International Caries Detection and Assessment System. ICDAS 5 = distinct cavity with visible dentin involvement.

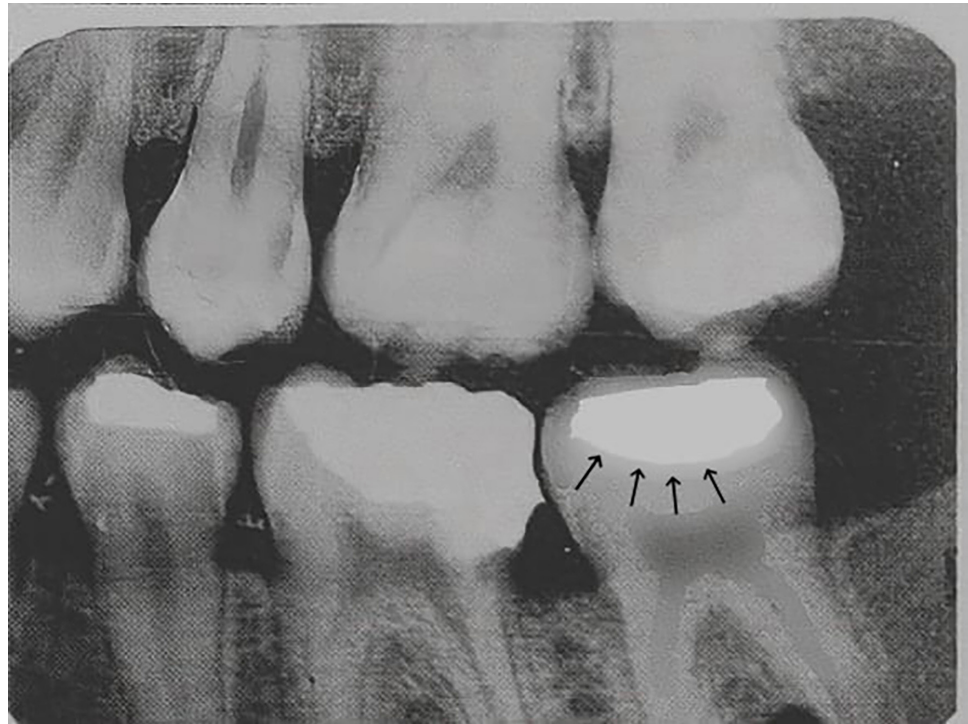


Fig 5 | Post op bitewing. Arrows indicating Class I restoration on tooth #37

Role of Composite Resins

The material of choice in this case is composite. This is because composites provide superior aesthetics, bond strength and are easy to manipulate. The composite used in this case was beneficial in terms of wear resistance, along with better polishing surface and strength. The strength provided by composite was suitable for posterior load-bearing areas.

Incremental layering technique was mandatory to minimize polymerization shrinkage and to avoid any polymerization stresses, which can affect the durability of the restoration. This also aided in complete curing and prevention of micro leakage and post operative sensitivity (Figure 5).

Importance of Rubber Dam Isolation

Control of moisture is important when using composite as a restorative material. In case of contamination of restoration with blood or saliva, the bond strength is affected to a great extent and the longevity of the restoration is also compromised.

To avoid contamination and to achieve moisture control, rubber dam isolation is mandatory. This helped in achieving a clean and dry field, which created a room of improvement in terms of procedural success and patient comfort.

Caries Removal Technique

For better outcome of the treatment, a conservative approach was made mandatory. Caries was removed selectively and cavity walls were prepared to firm dentin, rather than complete excavation to hard dentin. This approach is better when handling deep lesions.

The use of this approach was done to avoid the risk of pulpal exposure, which can initiate the need for endodontic treatment.⁷ Furthermore, it is of great significance in young patients, where dentin thickness can be observed less. To ensure this, caries detector dyes, tactile feedback and low speed burs were used for gaining precision in terms of caries removal.⁸

Restorative Outcomes and Longevity

High survival rates are observed when direct Class I restoration is done with proper technique. The longevity of this restoration is affected by various factors. These include:

- Isolation
- Bonding technique
- Patient's oral hygiene

However, in this case, the treatment outcome was favorable. This is because restoration remained asymptomatic and intact when observed during follow-up.

Clinical Significance

Several clinically relevant points are highlighted in this case. These include:

1. Early diagnosis: Diagnosis within time made it possible to prevent the caries progressing to irreversible pulpitis or pulpal necrosis, which can lead to endodontic treatment or extraction of the tooth.
2. Minimally invasive approach: This was done to ensure natural tooth structure is preserved to a great extent, which can become a source in providing retention to the restoration. This in turn will lead to better treatment outcome.

3. Selection of material: The selection of material was based to achieve esthetics of tooth and functional integrity of tooth at the same time. In this case, composite restoration was done to attain the previously mentioned objectives.
4. Educating the patient: Post treatment counseling was mandatory. This includes oral hygiene instructions and dietary practices. This aids in maintaining restoration and preventing recurrent caries.

Comparative Literature

The use of direct Composite restoration in deep lesions is favored by studies around the globe. Opdam et al. provided an insight that survival rate of restoration done by composite is far better than that of amalgam.⁹ However, proper isolation technique of placement is mandatory to achieve better survival rate.

Mickenausch et al. highlighted the importance of selective caries removal. The systematic review provided the significance of how selective caries removal can decrease pulpal exposure risks and decreases failure rates.¹⁰

In deep carious lesions, selective caries removal followed by sealing with an adhesive system provides outcomes comparable or superior to placing liners. Multiple systematic reviews and clinical studies report no significant benefit of liners (calcium hydroxide or RMGIC) under composite restorations in terms of post-operative sensitivity, pulpal healing, or restoration success.^{11,12} Instead, maintaining remaining dentin thickness and achieving a high-quality adhesive seal are primary determinants of pulp vitality and restoration longevity.

Furthermore, many studies also reinforce the fact that rubber dam isolation must be performed when doing direct Class I Composite restoration.¹³ This is because of improvements observed in longevity of restoration and reduction in post operative sensitivity.

Limitations

This case report represents a single-patient observation; therefore, its findings cannot be generalized. Longer follow-up and comparative clinical trials are necessary to validate these outcomes. Additionally, minor variations in operator skill and patient-specific oral hygiene may influence the long-term prognosis.

Conclusion

This case explains well the effectiveness of having a conservative approach towards treating deep carious lesions of Class I origin. The case highlights that this approach leads to success in achieving better treatment outcome of a direct Class I Composite restoration.

For preservation of pulp vitality and restoration of integrity of tooth in terms of functionality, it is mandatory to have an accurate diagnosis.¹⁴ Along with that careful caries excavation and adherence to strict isolation protocols is of prime significance.

Modern adhesive systems and nanohybrid composites are always a material of choice, when dealing deep carious lesions with minimally invasive strategies.¹⁵ This also aligns well with the principles

of contemporary restorative dentistry. By having such treatment approach, the need for more extensive interventions is reduced to a great extent. Furthermore, long term tooth preservation is also achieved.

In conclusion, this case highlights the fact that integrating evidence-based practices with appropriate techniques is very important. It aids in achieving successful outcomes in operative dentistry.

Patient Perspective and Ethical Considerations

The patient expressed satisfaction with the treatment outcome and reported relief from food impaction and comfort during mastication, reflecting the clinical success of the intervention. Written informed consent was obtained for the publication of this case report and its accompanying images. In line with institutional guidelines, ethical approval was not mandatory for this single-patient case, and an exemption/waiver was granted accordingly.

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