RESEARCH PAPER

Preoperative and Anesthetic Strategies for Managing an Addison's Disease patient Undergoing Dental Implant Fixation: A Case Report

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ABSTRACT

Background: Addison's disease, also known as primary adrenal insufficiency, is an uncommon endocrine disorder characterized by deficient secretion of glucocorticoids and mineralocorticoids by the adrenal cortex. Surgical interventions in affected individuals pose a significant risk of adrenal crisis due to increased physiological stress, necessitating careful perioperative planning and management. Although dental implant placement is considered a minor surgical procedure, it may induce substantial stress responses that require tailored anesthetic and endocrine considerations.

Case Presentation: A 42-year-old woman with a confirmed diagnosis of Addison's disease was referred for dental implant placement in the posterior mandibular region. A detailed preoperative evaluation was performed in collaboration with the patient's endocrinologist to optimize systemic health and minimize procedural risks. Perioperative corticosteroid supplementation was administered in accordance with established clinical recommendations to prevent adrenal insufficiency-related complications. Local anesthetic agents containing vasoconstrictors were carefully administered, and vital parameters, including blood pressure, heart rate, oxygen saturation, and patient anxiety levels, were continuously monitored throughout the procedure. Stress-reduction measures, such as scheduling a short morning appointment and ensuring adequate pain control, were incorporated into the treatment plan. The implant placement was completed successfully without any intraoperative or postoperative adverse events.

Results: The patient maintained stable hemodynamic parameters throughout the surgical procedure, with no signs of adrenal crisis, hypotension, electrolyte disturbances, or impaired wound healing. Postoperative recovery was satisfactory, and follow-up examinations confirmed successful implant osseointegration and favorable clinical outcomes.

Conclusion: Effective management of patients with Addison's disease undergoing dental implant surgery requires comprehensive preoperative assessment, interdisciplinary coordination, appropriate corticosteroid coverage, and individualized anesthetic protocols. This case emphasizes the importance of stress-management strategies and vigilant perioperative monitoring in minimizing adrenal-related complications and achieving successful implant rehabilitation. Adherence to established endocrine and anesthetic guidelines can significantly enhance patient safety and treatment outcomes.

Keywords: Addison's disease; Primary adrenal insufficiency; Dental implant placement; Perioperative care; Corticosteroid supplementation; Adrenal crisis prevention; Local anesthesia; Implant dentistry; Stress management; Case report; Endocrine disorders; Osseointegration.

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INTRODUCTION

Addison's disease, commonly known as primary adrenal insufficiency, is an uncommon endocrine disorder characterized by impaired adrenal cortical function resulting in insufficient secretion of glucocorticoids, mineralocorticoids, and adrenal androgens [1]. The disorder affects approximately 100–140 individuals per million population and is predominantly caused by autoimmune destruction of the adrenal glands in developed nations. Other etiological factors include infectious diseases, neoplastic conditions, and inherited genetic abnormalities [2]. Patients typically present with symptoms such as persistent fatigue, weight loss, hypotension, hyperpigmentation, electrolyte imbalances, and reduced tolerance to physiological stress. Inadequate treatment or exposure to significant stress may precipitate

an adrenal crisis, a serious and potentially fatal complication characterized by profound hypotension, dehydration, hypoglycemia, and circulatory failure [1-3].

The provision of dental care for patients with Addison's disease requires special consideration because procedural anxiety, pain, infection, and surgical trauma can substantially increase the body's demand for cortisol. Since these patients possess limited adrenal reserve, they are particularly vulnerable to stress-induced adrenal insufficiency [4]. Therefore, invasive dental procedures require meticulous preoperative assessment and perioperative management to minimize the risk of endocrine complications [5]. Perioperative corticosteroid supplementation has traditionally been advocated for patients undergoing stressful interventions; however, steroid coverage should be tailored according to the severity of adrenal dysfunction, current replacement therapy, and the anticipated surgical stress associated with the procedure [3].

Dental implant fixation is a well-established and highly predictable treatment option for the rehabilitation of missing teeth. Although implant placement is generally classified as a minor oral surgical procedure, it can generate considerable physiological and psychological stress, especially in medically compromised individuals [5-6]. Consequently, careful anesthetic planning, adequate pain management, anxiety control, and continuous monitoring of vital signs are essential to ensure patient safety. The cautious use of local anesthetic agents containing vasoconstrictors is generally considered safe; however, individualized assessment of cardiovascular stability and stress levels remains imperative throughout treatment [6-7].

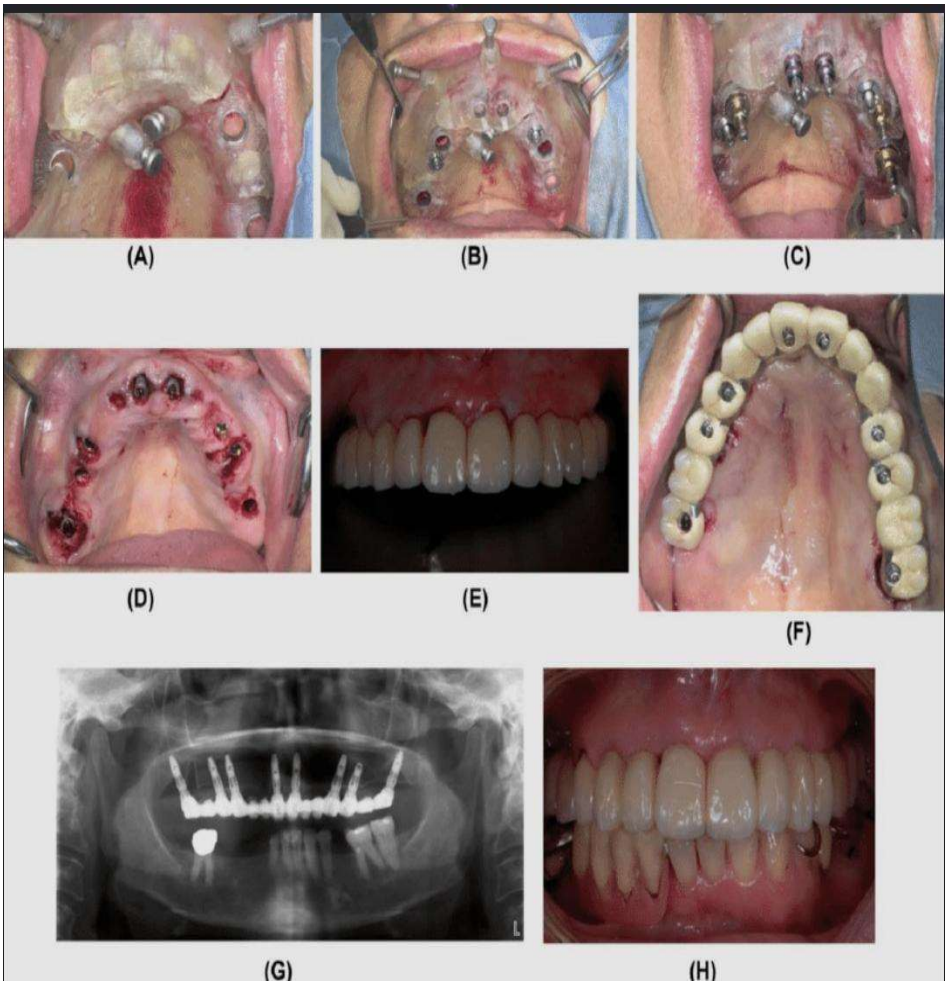
Successful management of patients with Addison's disease undergoing dental implant surgery necessitates a multidisciplinary approach involving dental surgeons, anesthesiologists, endocrinologists, and other healthcare professionals [8]. A comprehensive preoperative evaluation should include assessment of adrenal hormone replacement therapy, electrolyte balance, blood pressure regulation, and any previous episodes of adrenal crisis [9]. Furthermore, scheduling shorter morning appointments, implementing stress-reduction measures, providing effective analgesia, and ensuring appropriate corticosteroid supplementation can substantially reduce perioperative risks and enhance clinical outcomes [10].

This case report presents the preoperative assessment, anesthetic management, and perioperative care of a patient with Addison's disease undergoing dental implant fixation [11]. The case emphasizes the significance of individualized treatment planning, multidisciplinary coordination, and stress-reduction strategies in achieving safe and successful implant rehabilitation in patients with primary adrenal insufficiency [12].

Case Report:

A 37-year-old female patient with known case of Addison's Disease diagnosed to have Dental carries for that she underwent Dental Implant fixation under General Anaesthesia. She is a known case of Addison's Disease since age 5. She had a History of Slurring of speech and Microtremors which present all over body. She is an also a known case of Achalasia cardia in the past 2 years for that she underwent Oesophageal Baloon dilatation under General Anaesthesia 2 years back as she had a difficulty in deglutition for solid food. She has Lower Blood Pressure. Her drug history is T. Calcigard 5mg bd and T. Hydrocortisone 20mgbd. She had no known allergy. METS>4.On Oral Examination Tooth decay present. Adequate mouth opening. MP grade 2. On auscultation chest was clear. ECG shows Normal Sinus Rhythm. ECHO shows 62% Ejection Fraction, Grade 1 LVDD.

DENTAL IMPLANT FIXATION



Preoperative Management:
Preoperative optimization of the patient's condition one week before the scheduled surgery. All Routine tests were taken which revealed a preoperative hemoglobin level is about 10.1gm/dl. Serum electrolytes, Renal function test, Liver Function test, Thyroid function test and Serum Calcium were within Normal limits. Her blood pressure was closely monitored preoperatively. Other hemodynamic vitals were monitored preoperatively. Inj.Hydrocortisone 100mg was given 8th hourly since prior evening of Surgery. Before shifting to OT also, Inj.Hydrocortisone 100mg was given. An important part of the preoperative management was obtaining informed written consent, was done. This consent was obtained after extensive counselling to ensure she fully understood the risks associated with her decision.

Anesthetic Management:
In the preoperative room, the patient was preloaded with 500 mL of intravenous crystalloid solution over 20 minutes to maintain her intravascular volume and reduce the risk of intraoperative hypotension. Intraoperatively Blood pressure was cautiously maintained.

All basic monitors were connected and basal vitals of patient was noted. Patient in lying position. Preoxygenation was done with 100% Oxygen. Premediaction such as Inj.Midazolam 1mg and Inj.Glycopyrolate 0.2mg was given. Inj.Fentanyl 100mcg was given. Induced with Inj.Propofol 100mg iv and Relaxed with Inj.Atracurium 40mg was given. Using McIntosh Direct laryngoscopy nasotracheal intubation was done with 7 size North pole RAE tube. B/L Air entry was checked and connected to Ventilator of Volume Control Mode (VCV). Maintenance of Anaesthesia was done with Inhaled Volatile agent Isoflurane 1%Intraopertively Blood pressure and hemodynamic vitals were closely monitored. Capillary Blood Glucose (CBG) was monitored hourly once which was within Normal Limits. While surgery got over Volatile agent was cut 20 minutes prior to end of surgery. Extubation was done which is uneventful. Patient was fully awake.

The patient was closely monitored in the recovery room postoperatively, with a focus on her hemodynamic vitals. She remained stable and was transferred to the ward for further observation and recover.

INTRAOPERATIVE MONITOR

DISCUSSION

Addison's disease, also known as primary adrenal insufficiency, is an uncommon endocrine disorder with considerable geographical and population-based variation in occurrence [4-5]. Worldwide, the annual incidence is estimated to range between 0.6 and 1.1 cases per 100,000 individuals, while the prevalence varies from approximately 4 to 11 cases per 100,000 population [2]. Although considered a rare disease, recent epidemiological studies suggest a gradual increase in prevalence, which may be attributed to enhanced disease awareness, improved diagnostic capabilities, and the growing incidence of autoimmune disorders [1, 2, 4]. The condition can affect individuals of all age groups; however, it is most frequently diagnosed between the third and fifth decades of life and occurs more commonly in women than in men [5].

The pathogenesis of Addison's disease involves progressive destruction or impairment of the adrenal cortex, resulting in inadequate secretion of cortisol and aldosterone [2]. Autoimmune adrenalitis represents the predominant etiology in developed countries and accounts for approximately 70–90% of all cases [3, 12]. In this condition, autoimmune-mediated destruction of adrenal cortical tissue leads to gradual loss of endocrine function [12-15]. Autoimmune adrenalitis is frequently associated with autoimmune polyglandular syndromes [2, 4], particularly autoimmune polyglandular syndrome type 1 (APS-1) and type 2 (APS-2), in which adrenal insufficiency coexists with other autoimmune endocrine disorders [3-5].

Infectious diseases remain an important cause of Addison's disease, particularly in developing regions [2-3]. Tuberculosis continues to be one of the leading infectious etiologies worldwide and has historically been the most common cause of adrenal insufficiency. Other infectious agents implicated in adrenal destruction include fungal pathogens such as Histoplasma capsulatum and Coccidioides species, as well as opportunistic infections associated with human immunodeficiency virus (HIV) infection, including cytomegalovirus-related adrenalitis. These infections may cause extensive adrenal tissue damage, ultimately leading to adrenal failure [4-5]. Adrenal hemorrhage and infarction represent additional causes of primary adrenal insufficiency. Bilateral adrenal hemorrhage may occur in association with severe sepsis, particularly in Waterhouse–Friderichsen syndrome caused by meningococcal infection [4]. Other predisposing factors include anticoagulant therapy, major trauma, coagulopathies, and severe physiological stress, all of which can compromise adrenal vascular integrity and function [2, 5].

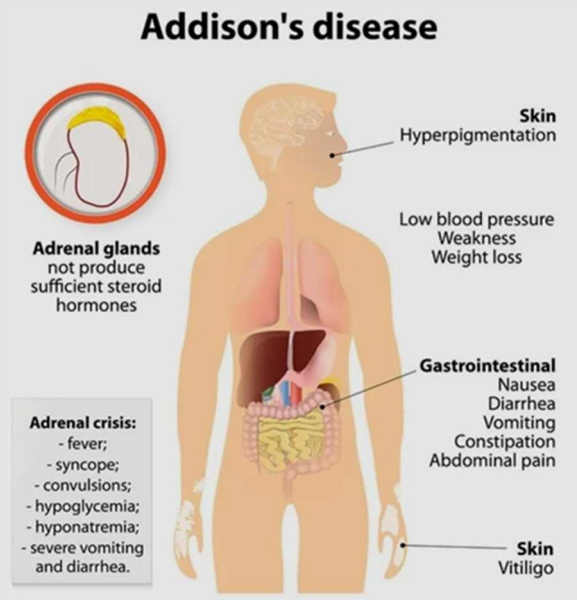
Several inherited and congenital disorders have also been associated with adrenal insufficiency [1]. Congenital adrenal hyperplasia, resulting from enzymatic defects in steroid biosynthesis pathways, may impair normal adrenal hormone production [3]. Adrenoleukodystrophy, an X-linked genetic disorder characterized by abnormal accumulation of very-long-chain fatty acids, can affect both the adrenal glands and the central nervous system, resulting in progressive adrenal dysfunction. Metastatic infiltration of the adrenal glands is another recognized

cause of Addison's disease [4-5, 12]. Malignancies such as lung carcinoma, breast carcinoma, melanoma, and lymphoma may spread to the adrenal glands and progressively destroy functional adrenal tissue [3]. Although adrenal metastases are relatively common in advanced cancer, clinical adrenal insufficiency typically develops only when extensive bilateral adrenal involvement occurs.

Drug-induced and iatrogenic causes should also be considered in the differential diagnosis of adrenal insufficiency. Prolonged glucocorticoid therapy followed by abrupt withdrawal can suppress the hypothalamic–pituitary–adrenal axis and precipitate adrenal insufficiency [14]. Additionally, several medications interfere with adrenal steroid synthesis or function, including ketoconazole, rifampin, etomidate, and immune checkpoint inhibitors such as pembrolizumab. These agents may impair cortisol production or trigger autoimmune-mediated adrenal injury, thereby increasing the risk of adrenal insufficiency [1, 15]. A thorough understanding of the diverse etiological factors and clinical manifestations of Addison's disease is essential for effective perioperative management [3, 12]. Early recognition, accurate diagnosis, and appropriate hormonal replacement therapy are critical in preventing adrenal crisis and ensuring favorable outcomes in patients undergoing surgical and dental procedures.

Pathophysiology of Addison's Disease:

Addison's disease (primary adrenal insufficiency) occurs due to the destruction or dysfunction of the adrenal cortex, leading to deficient production of cortisol, aldosterone, and adrenal androgens [1]. The pathophysiology involves the following key mechanisms:



Clinical Features of Addison's Disease and Anesthetic Considerations

Addison's disease, or primary adrenal insufficiency, is most commonly caused by autoimmune destruction of the adrenal cortex, resulting in impaired production of glucocorticoids, mineralocorticoids, and adrenal androgens [1-2]. In many cases, autoantibodies directed against the enzyme 21-hydroxylase contribute to adrenal gland destruction and may occur as part of autoimmune polyglandular syndromes [3-5]. The resulting hormonal deficiencies produce a wide spectrum of systemic manifestations that require careful consideration during surgical and dental procedures.

Cortisol deficiency compromises the body's ability to respond to physiological stress and increases susceptibility to adrenal crisis [14]. Patients commonly experience fatigue, generalized weakness, weight loss, and hypoglycemia due to impaired gluconeogenesis and altered energy metabolism. Reduced vascular responsiveness and diminished cardiac output may also lead to hypotension and circulatory instability [15]. Concurrent aldosterone deficiency disrupts sodium and water homeostasis, resulting in hyponatremia, hyperkalemia, hypovolemia, hypotension, and metabolic acidosis. In women, adrenal androgen deficiency may contribute to decreased libido, mood alterations, and loss of pubic and axillary hair [3-5]. A characteristic feature of primary adrenal insufficiency is elevated secretion of adrenocorticotropic hormone (ACTH) resulting from the loss of cortisol-mediated negative feedback at the hypothalamic-pituitary-adrenal axis. Increased ACTH levels stimulate melanocyte activity, producing the diffuse

mucocutaneous hyperpigmentation frequently observed in affected individuals [1-2]. One of the most serious complications of Addison's disease is adrenal crisis, a potentially life-threatening condition precipitated by infection, trauma, surgery [6], anesthesia [8], or other forms of physiological stress [8]. Adrenal crisis typically presents with severe hypotension, dehydration, electrolyte disturbances, hypoglycemia, and shock, requiring immediate treatment with intravenous hydrocortisone and aggressive fluid resuscitation [4-5].

The perioperative management of patients with Addison's disease requires meticulous planning to prevent adrenal insufficiency-related complications [1]. Preoperative assessment should include evaluation of adrenal hormone replacement therapy, electrolyte balance, blood pressure control, and overall hemodynamic stability [3, 12]. Administration of stress-dose corticosteroids before surgical intervention is recommended to compensate for the patient's limited endogenous cortisol production. Correction of hypovolemia, hyponatremia, hyperkalemia, and prevention of fasting-induced hypoglycemia are essential components of preoperative preparation [12].

During the intraoperative period, both local and general anesthesia may be administered safely when appropriate precautions are followed. Careful titration of anesthetic agents is necessary to avoid excessive cardiovascular depression and hypotension [6]. Etomidate should generally be avoided because of its inhibitory effect on adrenal steroid synthesis. Continuous monitoring of blood pressure, heart rate, oxygen saturation, blood glucose levels, and electrolyte status is recommended throughout the procedure [7]. Adequate intravenous fluid administration, including isotonic saline or glucose-containing solutions when indicated, helps maintain circulatory stability [8]. Vasopressor support may be required in cases of persistent hypotension despite corticosteroid supplementation and fluid replacement [4-5].

Postoperatively, patients should continue receiving stress-dose corticosteroid therapy with gradual tapering to maintenance doses according to endocrine recommendations [12]. Close observation is necessary to identify early signs of adrenal crisis, including persistent hypotension, fatigue, nausea, vomiting, confusion, or altered mental status [13]. Effective pain control, maintenance of fluid and electrolyte balance, and regular monitoring of blood glucose levels are important for ensuring an uncomplicated recovery [14-15]. Through comprehensive perioperative management and multidisciplinary collaboration, patients with Addison's disease can safely undergo dental implant surgery with favorable clinical outcomes.

Perioperative administration of stress-dose corticosteroids is essential to prevent adrenal insufficiency-related complications. Anesthetic agents that suppress adrenal function, such as etomidate, and medications associated with significant hypotension should be avoided whenever possible. Continuous monitoring of fluid status, electrolyte balance, blood pressure, and blood glucose levels is crucial throughout the perioperative period. Early identification and immediate management of adrenal crisis are vital to ensure patient safety and favorable clinical outcomes.

CONCLUSION

This case emphasizes the significance of thorough perioperative planning and individualized management in patients with Addison's disease undergoing dental implant fixation. Owing to the increased risk of adrenal crisis, comprehensive preoperative evaluation, optimization of corticosteroid replacement therapy, correction of fluid and electrolyte imbalances, and stabilization of hemodynamic parameters were fundamental components of patient care. The administration of appropriate stress-dose corticosteroid supplementation played a pivotal role in minimizing perioperative risks and preventing adrenal insufficiency-related complications.

During the surgical procedure, careful anesthetic management, continuous hemodynamic surveillance, and maintenance of electrolyte homeostasis contributed to stable intraoperative conditions [4]. Postoperative care focused on monitoring for signs of adrenal insufficiency, providing adequate analgesia, maintaining metabolic stability, and gradually reducing corticosteroid supplementation to maintenance levels, resulting in an uneventful recovery [5].

This case further highlights the importance of a multidisciplinary approach involving dental surgeons, anesthesiologists [6], and endocrinologists [14-15] in the successful management of patients with primary adrenal insufficiency [5]. Adherence to established perioperative steroid replacement protocols, vigilant monitoring, and coordinated interdisciplinary care are essential for reducing the risk of life-threatening complications and ensuring favorable surgical outcomes [6-8]. With appropriate preparation and management, patients with Addison's disease can safely undergo dental implant procedures and other surgical interventions with minimal perioperative risk [13].

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Conflict of Interest
The authors declare that there are no conflicts of interest regarding the publication of this case report.

Consent Declaration
Written informed consent was obtained from the patient for the publication of this case report, including all relevant clinical information and accompanying images. Every effort has been made to protect the patient's identity and maintain confidentiality.

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