

COMPARISON OF THE EFFICACY OF 4-0 POLYDIOXANONE AND 4-0 POLYGLACTIN 910 SUTURE MATERIAL IN MANDIBULAR 3RD MOLAR SURGERY – A SPLIT-MOUTH DOUBLE-BLINDED RANDOMIZED CONTROLLED STUDY

Comparación de la eficacia del material de sutura de polidioxanona 4-0 y poliglactina 910 4-0 en la cirugía de terceros molares mandibulares: estudio aleatorizado, controlado, doble ciego de boca dividida

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ABSTRACT

Aim: The study was to compare the clinical efficacy of 4-0 polydioxanone and 4-0 polyglactin 910 suture materials on postoperative outcomes after mandibular third molar surgery.

Methods: This split-mouth prospective study included 100 patients (200 surgical sites) requiring bilateral mandibular third molar extraction. The patients were randomly segregated into 2 groups. Group I included 100 patients who were sutured with 4-0 Polydioxanone, and group II included 100 patients who were sutured with 4-0 Polyglactin 910. All the participants were assessed for pain, facial swelling, mouth opening, and wound healing on the 1st, 3rd, and 7th postoperative days.

Results: The mean wound closure time in group I was 2.40 minutes ($p < 0.05$) and 4.16 minutes in group II. Pain, swelling, mouth opening and wound healing in group I ($p < 0.05$) were statistically significant on all three postoperative days when compared to group II.

Conclusion: Polydioxanone sutures provide superior clinical outcomes compared to polyglactin 910 in mandibular third molar surgery, particularly in terms of pain, edema, oral function and early healing.

Keywords: *Impacted tooth; Polydioxanone; Polyglactin 910; Sutures; Wound healing*

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RESUMEN

Objetivo: Comparar la eficacia clínica de los materiales de sutura de polidioxanona 4-0 y poliglactina 910 4-0 sobre los resultados postoperatorios después de la cirugía de terceros molares mandibulares.

Materiales y Métodos: Este estudio prospectivo de boca dividida incluyó a 100 pacientes (200 sitios quirúrgicos) que requerían la extracción bilateral de terceros molares mandibulares. Los pacientes fueron asignados aleatoriamente a dos grupos. El Grupo I incluyó 100 pacientes cuyos sitios quirúrgicos fueron suturados con polidioxanona 4-0, y el Grupo II incluyó 100 pacientes cuyos sitios quirúrgicos fueron suturados con poliglactina 910 4-0. Todos los participantes fueron evaluados en cuanto a dolor, inflamación facial, apertura bucal y cicatrización de la herida en los días 1.º, 3.º y 7.º del postoperatorio.

Resultados: El tiempo medio de cierre de la herida en el Grupo I fue de 2,40 minutos ($p < 0,05$), mientras que en el Grupo II fue de 4,16 minutos. El dolor, la inflamación, la apertura bucal y la cicatrización de la herida en el Grupo I ($p < 0,05$) mostraron diferencias estadísticamente significativas en los tres días postoperatorios evaluados, en comparación con el Grupo II.

Conclusión: Las suturas de polidioxanona proporcionan resultados clínicos superiores a las de poliglactina 910 en la cirugía de terceros molares mandibulares, especialmente en términos de dolor, edema, función oral y cicatrización temprana.

Palabras clave: *Diente impactado; Polidioxanona; Poliglactina 910; Suturas; Cicatrización de heridas*

INTRODUCTION

Surgical removal of mandibular third molars presents with postoperative complications.¹ The key determinant in the success of surgery and postoperative recovery is the preference and application of suture material.² Placement of surgical sutures approximates the wound margins and also stabilizes the surrounding tissues, controls bleeding, reduces dead space and enhances the wound healing process by facilitating primary closure. Inadequate or inappropriate wound closure may result in surgical site infection, delayed healing, tissue dehiscence and excessive scar formation.^{2,3} An ideal suture material must possess adequate tensile strength, knot security, minimal tissue reactivity, ease of handling and predictable absorption characteristics, withstanding the crucial intraoral environment.⁴ Factors such as constant mois-

ture, high microbial load, and continuous functional activity like speech and mastication can adversely affect the performance of suture materials used in the oral cavity.⁴⁻⁶ Polydioxanone (PDS) is a monofilament polyester composed of poly (*p*-dioxanone) known for its high tensile strength and prolonged absorption profile of up to 180 to 230 days for complete resorption through hydrolysis. PDS retains 70% of its tensile strength at two weeks, 50% at four weeks, and around 25% at six weeks. PDS sutures are relatively stiffer than braided sutures, hence it is difficult to handle and knot securely. However, its monofilament structure reduces the capillarity and bacterial adherence, making it advantageous in areas prone to infection.^{7,8} In contrast, Polyglactin 910 (Vicryl) is composed of 90% glycolide and 10% L-lactide. It is a braided, absorbable suture

that provides excellent knot security and is relatively easy to handle. It is absorbed by hydrolysis over approximately 56 to 70 days. Vicryl has high tensile strength; however, it declines rapidly after suture placement, retaining 65% at 7 days, 50% at 14 days, 40% at 21 days and a complete loss thereafter.

This makes polyglactin 910 suitable for short-term procedures. Its braided structure increases the surface area for bacterial adherence and may lead to higher inflammation in contaminated wounds.^{9,10}

In the present study, a split-mouth design was employed to eliminate inter-individual variability and provide a more accurate comparative assessment of 4-0 polydioxanone and 4-0 polyglactin 910 suture materials after mandibular third molar surgery.

MATERIALS AND METHODS

Study Design

This prospective split-mouth study was conducted over 2 years on 100 patients (200 surgical sites) who reported to the Department of Oral and Maxillofacial Surgery, Madha Dental College and Hospital, Chennai, for bilateral removal of impacted mandibular third molars.

Ethical approval for the present study was obtained from the ethical committee of our institution (MDCH/IEC/2022/09, Madha Dental College and Hospital, Chennai) and the study was conducted in accordance with the Helsinki Declaration. The study was registered with the Clinical Trial Registry of India (CTRI/2025/08/092795).

The nature of the study was explained in the regional language to all participants.

A written informed consent form in the vernacular language was signed by all the selected subjects included in this study.

Inclusion criteria were, Patients requi-

ring surgical removal of bilateral impacted man-dibular third molars with a Pederson difficulty index 3-5 (Type of angulation based on winter's classification - Mesioangular, depth of impaction - Level A,B and Ramus relationship - Class I, II based on Pell and Gregory classification), Healthy subjects >18 years of age, ASA I and II. Exclusion criteria were ASA III and IV, patients with known systemic diseases and immunocompromised individuals.

Sample Size Determination

The required sample size was calculated using G*Power software 3.1.92 based on the means and standard deviations of previous comparable studies, with a power of 95%, effect size 0.5 and an alpha error was set at 0.05.

The calculation yielded a minimum of 85 subjects, which was rounded to 100 patients to account for potential attrition. Since this study used a split-mouth design, the sample size was estimated at 200 (100 per group).

Blinding

In this study, double-blinding was used, with both the patient and the examiner being unaware of the type of suture material used after mandibular third molar surgery. The operating surgeon and the assistant were not blinded.

Randomization and allocation

The patients in this study were randomly allocated to groups using a block randomization method, and allocation concealment was performed by a third person who was not involved in the study.

Groups: Group I included 100 patients who were sutured with 4-0 Polydioxanone, and group II included 100 patients who were sutured with 4-0 Polyglactin 910 after mandibular third molar surgery.

Materials required: 4-0 Polydioxanone (PDS II, Ethicon, Johnson and Johnson Ltd, India), 4-0 Polyglactin 910 (Vicryl, Ethicon, Johnson and Johnson Ltd, India).

Surgical procedure

The surgical procedure was performed by an experienced single Oral Surgeon under an aseptic environment. Preoperative oral site preparation was done with 5% povidone iodine solution. Inferior alveolar nerve block was administered with 2% lidocaine and 1 in 80,000 adrenaline. A Ward's incision was placed using a No. 15 scalpel in both groups. A full-thickness mucoperiosteal flap was raised with a Molt's periosteal elevator to expose the impacted third molar.

Bone guttering was performed for all the participants using #702 bur under copious saline irrigation. The tooth was elevated or sectioned and retrieved using forceps. The socket was carefully examined for remnants, and the socket was irrigated well with saline. The extracted sockets were then closed primarily (surgeons knot) using PDS suture material (4-0 round body) in group I and Vicryl suture material (4-0 round body) in group II. Post-operative instructions were given to the subjects of both groups. All the participants were prescribed antibiotics (amoxicillin thrice daily) and analgesics (Ibuprofen 400mg twice daily) post-surgery for 3 days.

Follow-up and assessments

The follow-up assessments were performed by the examiner. Patients in this study were assessed for pain, swelling, mouth opening and wound healing on the 1st, 3rd and 7th post-operative days. Pain was assessed using a 10 cm visual analogue scale (vas). The score ranges between 0 and 10, where 0 represents no pain, 5 represents moderate pain, and 10 represents the worst possible

pain. Facial swelling was assessed manually using the craniometric method by measuring three anatomical points.

The measurement from the lateral canthus of the eye to the angle of the mandible was represented as S1, the measurement from the tragus of the ear to the corner of the mouth was represented as S2 and the measurement from the tragus of the ear to the soft tissue pogonion was represented as S3. The average of all three points was represented as swelling (S). Mouth opening was recorded using a string by measuring the distance between the upper and lower central incisors. Wound healing was evaluated using Landry's wound healing score.¹¹

Statistical Analysis

Data analysis was performed using IBM SPSS Statistics V23 software.

The Wilcoxon signed-rank test was used to compare the pain, swelling, mouth opening, and wound-healing parameters between groups, reporting mean differences and standard deviations. *p*-value <0.05 was considered statistically significant.

RESULTS

A total of 100 patients (200 surgical sites) who required removal of bilateral mandibular third molars were included in this study. Among 100 patients, 66 were male, and 34 were female, with an average age of 29 years. The obtained data were recorded in an excel worksheet and evaluated statistically using the Wilcoxon signed-rank test in SPSS software (Table 1).

Comparison of pain, swelling, mouth opening and wound healing between groups:

Wound closure time (min): The mean wound closure time in group I was 2.40 (0.71) and 4.16 (1.52) in group II, which showed a sta-

Table 1

Wilcoxon signed-rank test of statistical significance for Wound closure time, Pain, Swelling, Mouth opening and Wound healing between Group I and Group II

Parameters		Group I Mean (SD)	Group II Mean (SD)	p-value (<0.05)
Wound closure	time (min)	2.40 (0.71)	4.16 (1.52)	<0.001
Pain (vas)	Day 1	5.92 (1.24)	8.40 (0.81)	<0.001
	Day 3	2.93 (0.69)	5.73 (0.73)	<0.001
	Day 7	0.50 (0.57)	1.97 (0.76)	<0.001
Swelling (mm)	Day 1	14.67 (0.84)	15.81 (0.71)	<0.001
	Day 3	13.40 (0.62)	14.67 (0.66)	<0.001
	Day 7	12.61 (0.40)	13.86 (0.52)	<0.001
Mouth opening (mm)	Day 1	33.97 (1.06)	29.10 (0.95)	<0.001
	Day 3	35.63 (0.92)	30.50 (0.97)	<0.001
	Day 7	38.07 (0.86)	34.80 (0.66)	<0.001
Wound healing	Day 1	2.17 (0.48)	2.00 (0.53)	<0.001
	Day 3	3.16 (0.48)	2.87 (0.51)	<0.001
	Day 7	4.77 (0.43)	3.42 (0.43)	<0.001

tistical significance of $p<0.001$, respectively (Figure 1).

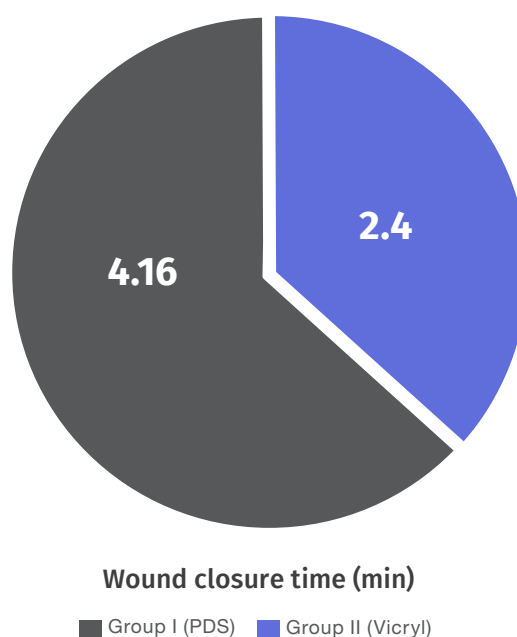
Pain (vas): The intensity of pain was less in group I compared to group II with a mean difference of 5.92 (1.24) on day 1, 2.93 (0.69) on day 3 and 0.50 (0.57) on day 7, which showed a statistical significance of $p<0.001$, respectively (Figure 2).

Swelling (mm): The amount of swelling was reduced in group I patients on 1st, 3rd and 7th postoperative days when compared to group II patients with a mean difference of 14.67 (0.84) on day 1, 13.40 (0.62) on day 3 and 12.61 (0.40) on day 7 which showed a statistical significance of $p<0.001$ respectively (Figure 3).

Mouth opening (mm): Mouth opening was improved in group I patients on all three postoperative days when compared to group II patients with a mean difference of 33.97 (1.06) on day 1, 35.63 (0.92) on day 3 and 38.07 (0.86) on day 7 which showed a statistical significance of $p<0.001$ respectively (Figure 4).

Figure 1

The average wound closure time between Group I and Group II



perative days when compared to group II patients, with a mean difference of 33.97 (1.06) on day 1, 35.63 (0.92) on day 3 and 38.07 (0.86) on day 7 which showed a statistical significance of $p < 0.001$, respectively (Figure 4).

Wound healing: The patients in group I had better soft tissue healing when compared to group II, with a mean difference of 2.17 (0.48) on day 1 and 3.16 (0.48) on day 3 and 4.77 (0.43), on day 7 which showed a statistical significance of $p < 0.001$, respectively (Figure 5).

Figure 2

Postoperative outcomes on pain between Group I and Group II evaluated at 1st, 3rd and 7th days

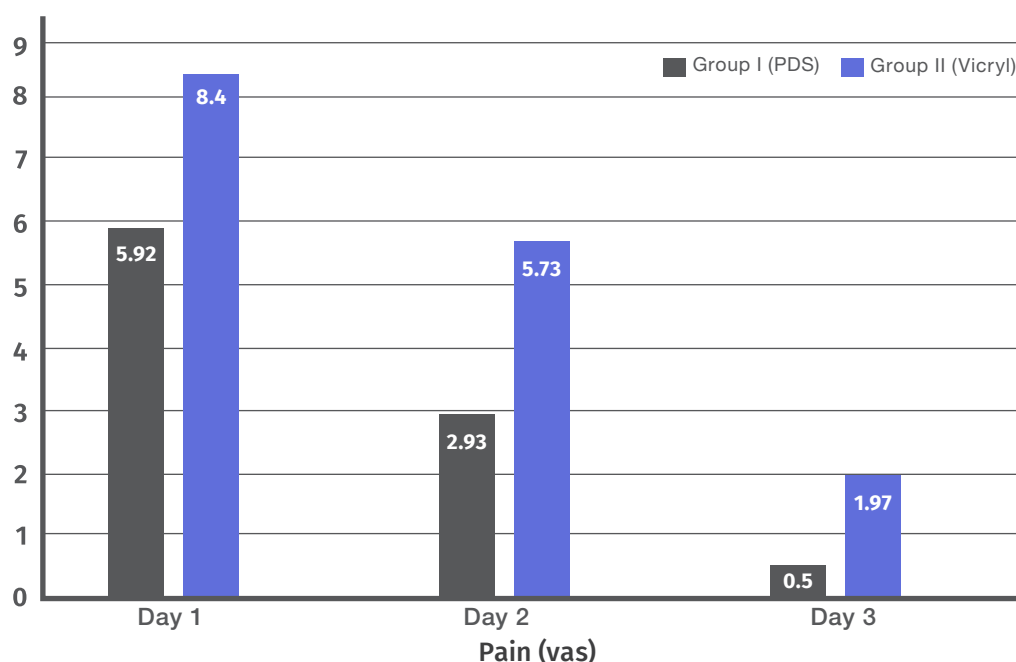


Figure 3

Postoperative outcomes on swelling between Group I and Group II evaluated at 1st, 3rd and 7th days

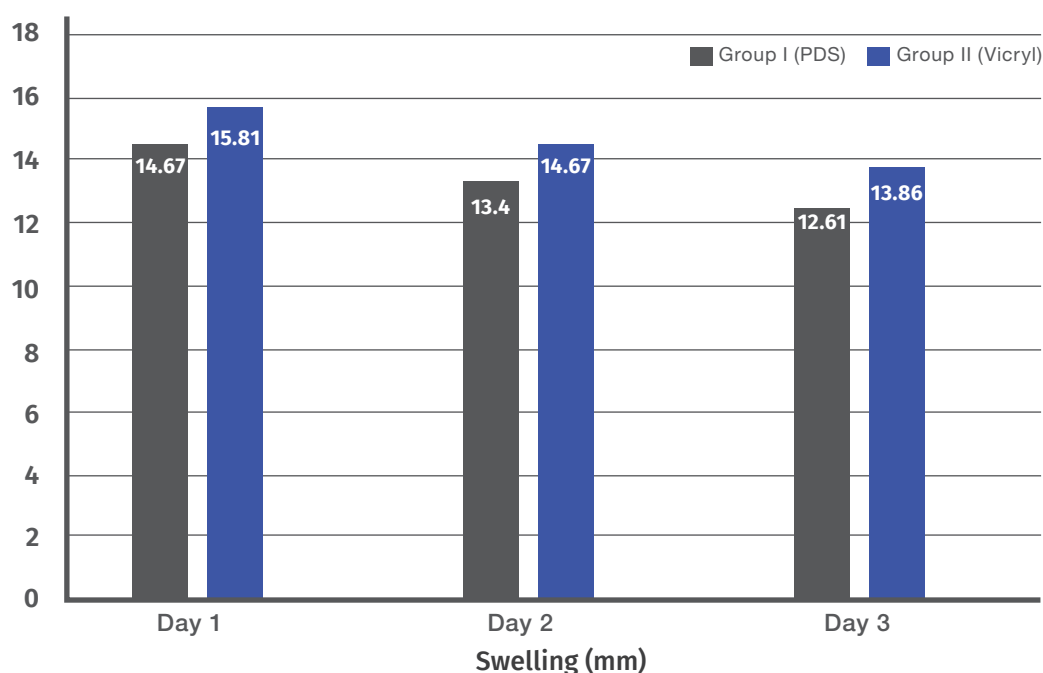


Figure 4

Postoperative outcomes on mouth opening between Group I and Group II evaluated at 1st, 3rd and 7th days

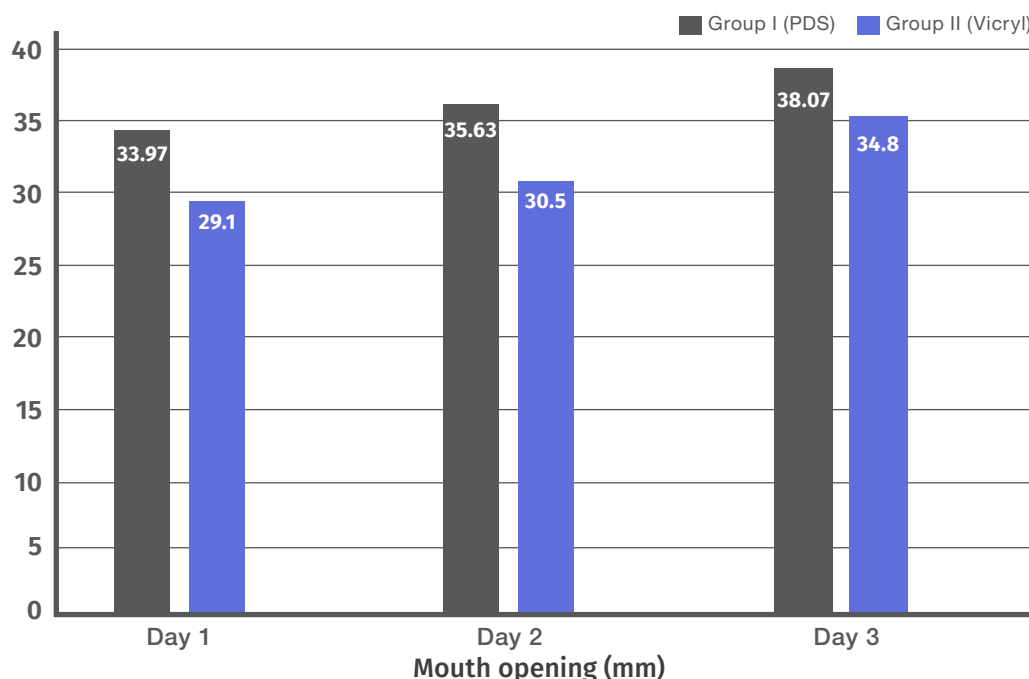
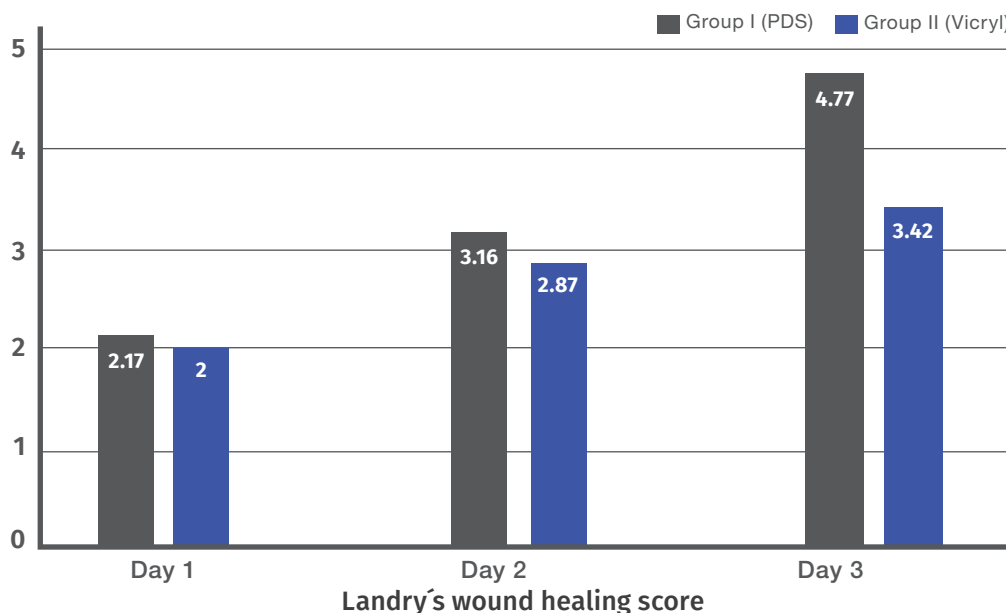


Figure 5

Postoperative outcomes on wound healing between Group I and Group II evaluated at 1st, 3rd and 7th days



DISCUSSION

The present study compares the efficacy of 4-0 polydioxanone and 4-0 polyglactin 910 suture materials on postoperative outcomes, including pain, swelling, mouth opening, and wound healing, after third molar surgery.

Healing of extraction sockets after surgical interventions is preferably approximated and sutured. Suturing can provide a relatively clean, plaque-free environment, which enhances healing and plays a vital role in wound stabilisation.¹² Ideal suture material should have specific physical characteris-

tics and properties such as resistance to traction, dimensional stability, absence of memory, knot safety, flexibility, prevention of damage to the oral mucosa, limited bacterial adhesion and wound contamination. However, sutures themselves can remain a nidus for the source of inflammation, which may reduce the potency for repair and regeneration.¹³⁻¹⁵

Polyglactin 910 and polydioxanone are among the most commonly used suture materials in oral and maxillofacial surgery.⁷ However, there is a lack of information on the behaviour of these materials in the oral cavity. Numerous specificities characterize the oral environment, primarily the presence of saliva, which varies in amount, pH, and immunoglobulin content.¹⁵

Besides, the presence of saliva, the oral cavity is characterized by the local immunogenic response, presence of saprophytic bacteria, accumulation of plaque on the surface of suture material, capillary effect and subsequent absorption of fluid by the material.¹⁶

The present study showed that the duration of wound closure in group I was shorter than in group II patients, which is consistent with Krishnan *et al.*,¹⁷ and Ceyar *et al.*¹⁸

One of the primary parameters evaluated was postoperative pain, which directly influences patient satisfaction and functional recovery. In the present study, group I patients experienced significantly less pain on all three postoperative days, as measured using the visual analogue scale. These findings were consistent with Ceyar *et al.*,¹⁸ and Guru *et al.*,¹⁹ who reported reduced inflammatory response and pain scores in wounds closed with monofilament sutures compared to braided alternatives. The lower tissue drag and decreased bacterial colonization associated with polydioxanone are likely contributing to the reduced nociceptive response observed.

Facial swelling, a hallmark of acute postoperative inflammation, also showed notable outcomes between groups. In the present study, group I patients showed reduced facial swelling compared with group II patients, with statistical significance ($p < 0.001$).

The above findings had a direct correlation with Ceyar *et al.*,¹⁸ and Guru *et al.*,¹⁹ This highlights that the monofilament structure of PDS results in less trauma to surrounding tissues and reduced capillary permeability, thereby limiting edema and tissue reaction. Conversely, braided sutures such as Vicryl may exacerbate the inflammatory cascade by harbouring microbial biofilms within the interstices of the braid.

The predominant indicator of postoperative recovery is the maximal mouth opening. In our study, although both groups exhibited restricted mouth opening post-surgery, the patients in group I had greater mouth opening than those in group II, with statistical significance ($p < 0.001$). Similar trends were observed in Ceyar *et al.*,¹⁸ and Guru *et al.*,¹⁹ which emphasize that a less inflammatory reaction and lower tissue resistance associated with monofilament sutures contribute to faster restoration of normal oral function. Knotless suturing techniques use tiny barbs, whereas knots attract debris. Knot slippage during tissue approximation may lead to inadequate wound closure and wound dehiscence. Knotting also reduces the tensile strength of the suture material by 35% to 95% due to structural deformation. While the barbs in the suture prevent tissue sliding.²⁰

The mean wound-healing scores in group I patients ($p < 0.05$) showed better, faster healing compared to group II patients, which was consistent with the findings of Idupulapati *et al.*,³ and Sharma *et al.*²¹ Additionally, Sharma *et al.*,²¹ reported good wound approximation and less inflammation.

On the contrary, Filho *et al.*,²² stated that polyglactin 910 has proven clinically excellent, as it does not promote plaque adherence, causes minimal local reaction, and is well suited for easy handling.

The key difference between polydioxanone and polyglactin is that polydioxanone is a monofilament suture with a longer absorption time and greater initial tensile strength than polyglactin.²³ While, polyglactin is a braided multifilament suture that absorbs faster, signifying polydioxanone, a suitable material for conditions requiring prolonged wound support.

Polyglactin is often used for tissues that require faster healing, where rapid absorption is desired. However, the best choice of suture material depends on the specific surgical procedure and desired healing time.²⁴ The present study had a few limitations: the sample size was small; hence, studies conducted with a larger population may yield better postoperative outcomes.

The follow-up duration was limited to 7 days, which may be insufficient to capture the late-stage healing outcomes, such as complete epithelial maturation or delayed inflammatory responses. The facial swelling was not evaluated using a digital or three-dimensional assessment protocol, which, if incorporated, would have resulted in better postoperative accuracy.

CONCLUSIONS

This split-mouth study demonstrates that 4-0 polydioxanone offers superior clinical performance compared to 4-0 polyglactin 910 in mandibular third molar surgeries. Patients sutured with PDS experienced reduced postoperative pain, less facial swelling, better mouth opening, and more favourable wound healing. These findings support the selective use of PDS in third molar surgeries to enhance early recovery outcomes.

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CONFLICT OF INTERESTS

The authors have no relevant financial or non-financial interests to disclose..

ETHICS APPROVAL

Ethical approval was obtained from the ethical committee of our institution (MDCH/IEC/2022/09, Madha Dental College and Hospital, Chennai).

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AUTHORS' CONTRIBUTIONS

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Deepak Abraham Pandyan: Methodology, Study Design.

Satheesh Chandran: Data Curation, Investigation.

Deenadayalan Narasimman: Data Curation, Investigation.

George Samyo Stephensonr: Writing – Original Draft Preparation, Manuscript Drafting.

Balamurugan Rajendran: Writing – Original Draft Preparation, Manuscript Drafting.

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