Labral repair, reconstruction, and augmentation improve postoperative outcomes in patients with irreparable or hypoplastic labra: A systematic review

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Systematic Review

Labral repair, reconstruction, and augmentation improve postoperative outcomes in patients with irreparable or hypoplastic labra: A systematic review

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ABSTRACT

Purpose: To review the postoperative outcomes of arthroscopic surgical options in treating irreparable and hypoplastic labrum of the hip.
Methods: Three online databases (PubMed, MEDLINE, and EMBASE) were searched from database inception to June 27, 2023 to identify literature on treatment strategies for hypoplastic/irreparable acetabular labrum. Data pertaining to classification of irreparable tears or labral hypoplasia, indication for surgery, description of treatment, radiographic findings, and clinical outcomes were recorded and described. The methodological quality of included studies was assessed by the Methodological Index for Non-Randomized Studies (MINORS) criteria.
Results: Seven level IV case series, eleven level III retrospective cohort studies, and two level II prospective cohort studies comprising 1937 patients were included for analysis. Studies were divided into an irreparable labral group comprising 1002 patients and a hypoplastic labral group comprising 935 patients. Treatments included repair, augmentation, or reconstruction. In the irreparable group, 12 studies recorded improvement of modified Harris Hip Score (mHHS) with preoperative scores ranging from 50.3 to 67.3 and postoperative scores ranging from 76.2 to 95.0. The rate of conversion to total hip arthroplasty (THA) and rate of revision arthroscopy were 6.6% and 5.9%, respectively across all studies. In the hypoplastic group, two studies that focused on repair noted no statistical difference in mHHS for repair in hypoplastic labrum vs repair in non-hypoplastic labrum. One study showed that there was a difference in post-operative mHHS for labral repair for hypoplastic vs non-hypoplastic labrum, with repair in non-hypoplastic labrum showing superior mHHS ($p < 0.001$).
Conclusion: The findings of this review suggest that treatment of irreparable labra with reconstruction or augmentation results in improved patient-reported outcome measures (PROMs). For the hypoplastic labrum, primary repair also results in improvement in PROMs. Future studies focusing on the hypoplastic labra alone with an appropriate control group, rather than irreparable labral tears, are needed to properly assess patient outcomes and guide surgical indications.

What is already known

- Labral tears are one of the leading causes for hip arthroscopy, and can be treated by repair, reconstruction, or augmentation.
- Irreparable and hypoplastic labra pose a challenge for orthopaedic surgeons, and there is currently no consensus on which surgical method is most effective.

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What are the new findings

- This study revealed that both reconstruction and augmentation improve patient-reported outcome measures (PROMs) for patients with irreparable labra.
- Primary repair of hypoplastic labra resulted in improved PROMs; however, more studies focusing solely on the management of hypoplastic labra are needed to better understand the effects of different surgical techniques.
- Use of autografts for labral reconstruction has increased.

INTRODUCTION

The treatment of labral tears is one of the leading indications for hip arthroscopy with 22%–55% of patients with painful hips having labral tears [1–4]. Labral tears can occur in the setting of paediatric, trauma, or degenerative conditions [5–7]. The labrum of the hip serves to create a suction seal for the hip joint, stabilise the hip joint, and prevent egress of synovial fluid from the hip joint [6,8–10]. Options for treatment of labral tears include repair, augmentation, and reconstruction [11,12].

Repairing the labrum typically involves reattaching it to the acetabulum using suture anchors. This can be done using a loop technique in which the sutures are placed around the entire labrum or using a base stitch technique in which the base of the labral is repaired to the acetabulum [3,13]. Reconstruction involves removing the remaining labral tissue and replacing it with either autograft or allograft [3,14,15]. Augmentation is a procedure in which the native labral tissue is left in place; however, additional tissue, autograft, or allograft is used to reinforce the native tissue [12,13].

Labral hypoplasia is one of the indications for immediate reconstruction, with proponents noting that the hypoplastic labrum cannot serve its function properly [15–18]. However, there are some who believe that even with labral hypoplasia the labrum can be repaired or augmented. Proponents for repair note the advantage of having the patient's native tissue present that serves to preserve proprioceptive and nociceptive function of the labrum [19]. In the setting of the irreparable labrum, primary reconstruction is increasingly being utilised as a treatment strategy instead of debridement, which was the historical standard [20].

The advantage of augmentation is that it leaves the native tissue in situ thus preserving proprioceptive function. However, it provides additional tissue that improves the suction seal mechanism of the labrum [8,19]. On the other hand, this procedure can be technically demanding, as well as potentially increase surgical time and complications [14].

The aim of this systematic review was to review the characteristics and postoperative outcomes of arthroscopic surgical options in treating irreparable and hypoplastic labral tears. Our hypothesis is that all treatment options reviewed will provide short-term and mid-term improvements in patient outcomes.

METHODS

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and MetaAnalyses (PRISMA) [21,22].

Search strategy

Three online databases (PubMed, MEDLINE, EMBASE) were searched from database inception to June 27th, 2023 to identify literature on treatment strategies for hypoplastic/irreparable acetabular labrum. Broad search terms were used including "Labral OR Labrum", "reconstruction OR augmentation OR repair" and "Hip" (Supplementary Material Table 1). Studies were eligible if they met the following inclusion criteria: (1) studies reporting on treatment strategies for irreparable labrum or degenerative labrum (including hypoplasia, calcification, or complex tears) with a minimum mean two-year follow-up period (2) studies including a patient population with only hypoplastic labrum regardless of follow-up time (3) non-cadaveric studies, (4) human studies and (5) studies published in the English language. Exclusion criteria were (1) systematic reviews or meta-analyses, (2) textbook chapters, (3) conference abstracts, (4) level of evidence V, (5) studies with less than five patients, and (6) simulation or model-based studies.

Studies including all forms of irreparable labral tears were only included if there was a minimum two-year follow-up. However, studies focusing specifically on patients with hypoplastic labra were included without a requirement for minimum follow-up time due to the limited number of studies on this specific pathology.

Study screening

Two authors independently screened the titles and abstracts of the retrieved articles. The titles and abstracts were reviewed concurrently. Any disagreements regarding inclusion were resolved by consensus among the reviewers, and a more senior author was consulted for any remaining discrepancies. During the full-text phase, studies were independently screened, and emerging conflicts were resolved once consensus was reached amongst reviewers.

Assessment of agreement

The kappa (κ) statistic was used to assess inter-reviewer agreement at all screening and quality assessment steps. A priori classification was as follows: κ of 0.91–0.99 was classified as almost perfect agreement; κ of 0.71–0.90 was considerable agreement; k of 0.61–0.70 was high agreement; κ of 0.41–0.60 was moderate agreement; κ of 0.21–0.40 was fair agreement and a κ value of 0.20 or less was classified as no agreement [23].

The intraclass correlation coefficient (ICC) was used to assess inter-reviewer agreement for quality assessment of studies. A priori classification was as follows: ICC above 0.90 indicated excellent reliability, ICC between 0.75 and 0.9 indicated good reliability, ICC between 0.5 and 0.75 indicated moderate reliability, and ICC less than 0.5 indicated poor reliability [24].

Quality assessment

The methodological quality of all studies was assessed by the Methodological Index for Non-Randomized Studies (MINORS) criteria [25]. Based on the MINORS criteria, non-comparative and comparative studies can receive a maximum score of 16 and 24, respectively. For non-comparative studies, classification was based on a previous systematic review as follows: 0–4 very low quality evidence, 5–7 low quality, 8–12 fair quality, and scores $\geq$13 high quality [26]. Comparative studies were categorised as: 0–6 very low quality, 7–10 low quality, 11–15 fair quality, 16–20 good quality, and $\geq$20 high quality [26].

Data abstraction

Two reviewers independently extracted and summarised data from included articles using Google Sheets (Google LLC, Mountain View, CA, USA). Demographic data such as patient age, sex, and loss to follow-up were recorded. Treatment group, classification of hypoplasia, indication for surgery, description of treatment, radiographic findings, and clinical outcomes were recorded.

Statistical analysis

Given the non-uniform nature of the studies included in this review, results were presented in a narrative summary fashion. Means, ranges, standard deviations (SD), 95% confidence intervals (CI), and proportions were presented and calculated using Google Sheets (Google LLC, Mountain View, CA, USA).

RESULTS

Literature search

The initial search resulted in 2864 studies, of which 1590 were duplicates. Of the 1274 remaining, 48 were selected for full-text screening after abstract and title screening. Twenty full-text articles satisfied the eligibility criteria and were included in the final analysis (Fig. 1). There was high agreement during title and abstract screening (κ = 0.82, 95%CI 0.76–0.87) and full-text stages (κ = 0.81, 95%CI 0.68–0.94).

Study quality

Of the 20 studies included in this review, two were level II prospective cohort studies (10%), eleven were level III retrospective cohort studies (55%), and seven were level IV case series type studies (45%). The mean

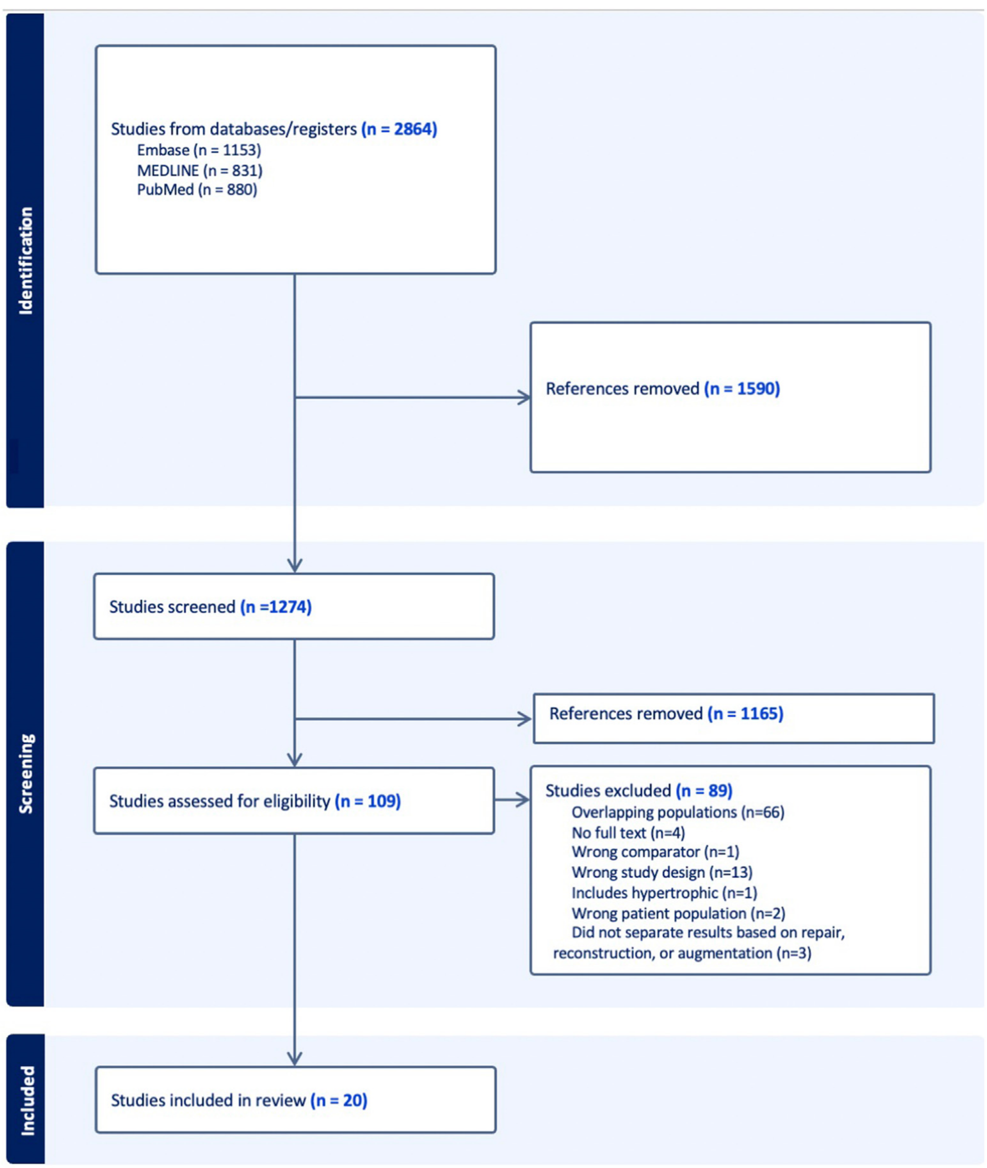

Fig. 1. PRISMA flow diagram.

MINORS score for non-comparative and comparative studies were 9.8 (fair quality) and 18.5 (good quality), respectively. There was good agreement between reviewers for quality assessment with an ICC of 0.83 (95%CI 0.62–0.93).

Study demographics

Irreparable (hypoplastic, complex tears, calcified) labra

Fifteen studies included patients with labra that were deemed irreparable (hypoplastic, calcified, deficient, complex tearing etc.) [27–41]. These studies did not separate outcomes for the underlying pathology. Of the 1002 patients included (1002 hips), 53.3% were female, the mean age was 40.1 years (range 15–71 years), and the mean follow-up was 36.1 months (range 22.0–136.5 months. The mean BMI across all studies that reported it was 25.2 kg/m^2 (range 17.0–34.0 kg/m^2) (Table 1).

Hypoplastic labra

Five studies reported outcomes for patients with specifically hypoplastic labra alone. Three studies defined hypoplastic labra, with definitions including below one standard deviation below the mean [42], widths below 4 mm [43], and widths below 1–2 mm [44]. In this cohort, there were 935 patients (935 hips) who underwent treatment [1,42–45], comprising 59.6% females with a mean age of 33.3 years (range 19.0–25.4 years). The mean follow-up time was 26.9 months (range 5.0–113.0 months). BMI was reported in two studies, with a mean value of 25.2 kg/m^2 (range: 25.0–25.4 kg/m^2) (Table 1).

The mean number of patients per included study was 187 (range 5–638). The mean follow-up time was 26.9 months (range 5.0–113.0 months). Females comprised an average of 59.6% of the included patients, and the mean age of all patients was 33.3 years (range 19.0–50.0 years). BMI was reported in two studies, with a mean value of 25.2 kg/m^2 (range: 25.0–25.4) (Table 1).

Radiographic characteristics

Irreparable (hypoplastic, complex tears, calcified) labra

Five studies provided a description of labral hypoplasia. Two studies defined a hypoplastic labrum as a labral width below 3 mm [38,39], while three studies depicted a labral width as below 5 mm [34,35,41]. Five studies provided a description of a complex labral tear deemed to be irreparable [30,34,38,39,41]. Three studies provided a description of a multiplane injury with over 50% of substance at tear site with or without rim stability [30,38,39]. One study defined a complex tear to be a tear that has completely disrupted the longitudinal fibres of the labrum [34]. Eleven studies reported on Tonnis grades. The majority of patients were either classified as a grade zero or one Tonnis grade, with only 78 patients being a grade two [30–33,35–41] (Table 2).

Hypoplastic labra

Four studies provided definitions for labral width [1,42–44]. Two studies reported a definition of a hypoplastic labrum of 1–2 mm and <4 mm, respectively [43,44]. Another study defined labral hypoplasia as a labral width less than one standard deviation below the mean [42]. One additional study reported that the bottom decile and quartile of labral widths in the study population were 3.2 and 3.8 mm, respectively [1]. All four of these studies reported a Tonnis grade of one or less (Table 2).

Irreparable (hypoplastic, complex tears, calcified) labrum management

Labral reconstruction

Fifteen studies reported on labral reconstruction graft types [27–41]. Autograft and allograft were used in 550 (54.9%) and 452 (45.1%) patients, respectively. Of the allografts used, the most prevalent were iliotibial band and fascia lata allografts used in 149 (33.0%) and 145 (32.1%) patients, respectively. Allografts were unspecified in 43 patients (9.5%). Of autografts used, the most prevalent were iliotibial autografts and capsular autografts in 401 (72.9%) and 115 (20.9%) patients, respectively. Autografts were unspecified in 4 patients (0.73%). Segmental and circumferential reconstructions were performed in 735 (73.4%) and 267 (26.6%) patients, respectively. Concomitant procedures and postoperative rehabilitation protocols are depicted in Table 3.

Twelve studies reported on mean modified hip Harris score (mHHS) values, with preoperative scores ranging from 50.3 to 67.3 and postoperative scores ranging from 76.2 to 95.0 [27,29,31,33–39,41]. Eleven studies reported a significant improvement in scores postoperatively ($p < 0.0001$) [27,29,31,33–38,40,41].

Seven studies reported on mean visual analogue scale (VAS) scores, with preoperative scores ranging from 4.7 to 7.8 and postoperative scores ranging from 1.9 to 3.5 [27,29,30,33,36,37,39]. Five studies reported a significant improvement in scores postoperatively ($p < 0.001$) [27,30,33,36,37].

Six studies reported mean international hip outcome tool-12 or 33 (iHOT-12 or iHOT33) scores, with preoperative scores ranging from 32.8 to 40.4 and postoperative scores ranging from 65.8 to 79.5 [29,30,33,35,38,39]. Four studies reported a significant increase in postoperative scores ($p < 0.01$) [30,33,35,38].

Mean mHHS, VAS, and iHOT scores were similar between those either receiving allografts or autografts and between those receiving either segmental or circumferential reconstruction.

Of a total of 1002 patients receiving reconstruction, 66 (6.6%) had a conversion to a THA and 59 (5.9%) had a revision arthroscopy. Among patients receiving allografts, autografts, segmental reconstruction, and circumferential reconstruction, the rate of conversion to THA was 3.2% (13/409), 8.4% (46/546), 8.2% (57/690), and 3.0% (8/265), respectively. The rate of revision arthroscopy across all treatments ranged from 2.0% to 7.2% (409–690 total patients).

There were ten additional adverse events reported in three studies (133 patients, 7.5%). Two patients had pudendal neuropraxia and one patient had peroneal neuropraxia. Six patients had heterotopic ossification and one had a superficial infection resolved with infection (Table 4).

Labral augmentation

One study reported on labral augmentation for revision hip arthroscopy [28]. This study used an iliotibial band autograft and allograft in 39 and 38 patients, respectively. A total of five of 88 (6.5%) patients converted to THA. Re-revision hip arthroscopy was required in 11 of 88 (14%) patients (Table 4).

Hypoplastic labrum management

Three studies reported on labral repair [1,42,43]. One study each reported a significant increase in mHHS, iHOT-12, and VAS scores pre-to postoperatively in patients with labral widths below 4 mm [43]. Two studies found no significant differences in PROMs postoperatively between those with hypoplastic and non-hypoplastic labra [43,46]. One study reported using segmental labral reconstruction with a ligamentum teres capitis graft, finding a mean increase in UCLA score of 3.2 postoperatively [45]. One study reported using segmental labral augmentation with a ligamentum teres autograft, reporting a revision rate of 6.7% and mean (SD) postoperative score of 42.0 (9.1) [44].

There were two conversions to THA in two studies comprising 108 (1.9%) patients [42,45], with one patient receiving reconstruction and repair each. Revision arthroscopy was necessary in 15 of 935 total patients (1.6%) of patients. The revision rate for those who received repair, reconstruction, and augmentation were 1.5% (11/746), 0% (0/5), 6.3% (1/16), respectively (Table 5).

DISCUSSION

In the irreparable group, patients who underwent labral reconstruction had significant improvement in the postoperative PROMs regardless of graft type or technique. Patients who underwent labral augmentation

Table 1
Patient demographics.

Author (year)	Level of evidence	MINORS score	No. of patients	Mean follow-up (SD) in months	Lost to follow-up (%)	Female (%)	Mean age (SD) years	Mean BMI (kg/m^2)	Revision or primary surgery
Treatment: reconstruction									
White (2023)	IV	10.5/16	52	46.2 (27–68)	8%	77%	42.2 (15–57)	NR	Primary: n = 44 Revision: n = 3
Bodendorfer (2022)	III	20/24	SLR: 53 CLR: 51	25.6 (3.2)	0%	SLR: 56.6% CLR: 52.9%	SLR: 43.9 (12.4) CLR: 42.4 (11.2)	SLR: 25.6 (4.6) CLR: 24.1 (3.1)	Primary: n = 104
Jimenez (2022)	III	12.5/16	50	31.7 (9.3)	7.84%	66%	29.6 (9.7)	24.5 (4.5)	Revision: n = 47
Kocaoglu (2022)	II	18/24	42	IT: 32.7 (5.5) TA: 34.6 (5.7)	IT: 8.33% TA: 4.16%	IT: 65.0% TA: 68.2%	IT: 34.55 (8.86) TA: 30.64 (6.22)	NR	Primary: n = 42
Scanaliato (2022)	III	18.5/24	62	60.4 (1.5)	0%	62.9%	38.3 (11.2)	23.3 (3.3)	Primary: n = 62
Deng (2021)	III	9.5/16	21	57.14	0%	57.1%	46.7 (5.7)	NR	NR
Kucharik (2021)	IV	8.5/16	94	28.2 (range 26–30.4)	0%	50.50%	39.0 (range 36.8–41.2)	25.8 (24.9–26.7)	Primary: n = 94
Maldonado (2020)	III	19/24	37	25.5 (1.6)	0%	51.4%	45.6 (11.6)	21.7 (5.0)	Primary: n = 37
Nakashima (2019)	III	19.5/24	25	37.0 (13.2)	0%	28%	52.6 (15.0)	24.3 (2.5)	Primary: 25
Amar (2018)	III	11/16	22	Median: 36.2 (range 24–72)	0%	40.90%	42.0 (range 22–68)	NR	Revision: n = 14 Primary: n = 8
Carriera (2018)	III	11.5/16	31	31.6 (range 24–46)	8.82%	64.52%	43.7 (9.2)	24.2 (4.0)	Revision: n = 6 Primary: n-25
Lebus (2018)	IV	11.5/16	317	44.4 (range 24.0–135.6)	13.9%	44.8%	44.8	34.6	Primary: n = 116 Revision: n = 195
Scanaliato (2018)	III	19.5/24	63	24.0 (1.9)	8%	59%	43.4 (10.7)	24.6 (3.8)	Primary: n = 63
Matsuda (2013)	III	12/24	8	30 (range 24–37)	0%	12%	34.63 (14.97)	28.37 (5.63)	NR
Sierra (2009)	II	8/16	5	10 (range: 5–20)	0%	40%	32.6 years (range 19–50)	NR	Primary: n = 2 Revision: n = 3
Treatment: augmentation									
Soares (2022)	IV	8.5/16	88	62.4 (14.4)	12%	61%	32.8 (11)	NR	Revision: n = 88
Weidner (2018)	IV	6.5/16	16	12	6.30%	56.30%	29	NR	Primary: n = 12 Revision: n = 4
Treatment: repair									
Kaplan (2021)	IV	12/16	103	76.5 (19.1)	0%	68.2%	39.4 (12.4)	25.0 (4.2)	Primary: n = 103
Brinkman (2020)	IV	6.5/16	638	24 (minimum)	10.50%	56%	34.2	NR	Primary: n = 571
Drager (2020)	III	21.5/24	173	12	2.30%	77.50%	31.5 (12.0)	25.4 (5.1)	Primary: n = 173

NR = not reported; MINORS = methodological items for non-randomized studies; SD = standard deviation; BMI = body mass index.

Table 2
Hip characteristics.

Author (year)	Labral width (mm)	Definition of labral hypoplasia	Definition of complex tear	Indications for reconstruction, repair or augmentation	Tonnis grade	Alpha angle (SD)	ACEA (SD)	LCEA (SD)	Outerbridge classification score – acetabulum (%)	Outerbridge classification score – femoral head (%)
Treatment: reconstruction										
White (2023)	NR	NR	NR	Irreparable labrum	NR	Pre-op: 62.44 (6.66) Post-op: 42.87 (2.35) Change: 19.49 (7.47)	NR	Pre-op: 49.21 (5.37) Post-op: 35.4 (1.96) Change: 13.96 (5.97)	NR	NR
Bodendorfer (2022)	Hypoplasia defined as <3 mm SLR: 18.9% hypoplasia CLR: 25.5% hypoplasia	12-2 o'clock, graded with 1 mm markings with arthroscopic probe, <3 mm width	None Mild (stable rim configuration with some fraying) Moderate (rim stability and intra-substance damage greater than fraying but still <50% of substance at tear site) Severe (complex, multiplane injury >50% of substance at tear site with or without stability at rim)	Complex or extensive tearing, labral hypotrophy and hypertrophy, labral calcification	Grade 1 or less	SLR: Pre-op: 72.5 (10.7) Post-op: 47.9 (5.5) CLR: Pre-op: 69.3 (12.1) Post-op: 48.4 (4.7)	SLR: Pre-op: 36.5 (8.8) Post-op: 34.4 (6.1) CLR: Pre-op: 32.0 (8.2) Post-op: 34.9 (8.4)	SLR: Pre-op: 37.0 (8.2) Post-op: 32.5 (5.3) CLR: Pre-op: 36.3 (10.1) Post-op: 32.5 (5.6)	NR	NR
Jiminez (2022)	NR	NR	NR	Calcified, nonviable tissues, irreparable	Pre-op: Grade 0: 42/47 Grade 1: 5/47 Post-op: Grade 0: 40/47 Grade 1: 7/47	Pre-op: 52.2 (12.4) Post-op: 45.4 (6.4)	Pre-op: 34.1 (6.7) Post-op: 31.6 (6.3)	Pre-op: 30.9 (5.4) Post-op: 28.6 (5.5)	0: 2 (4.3%) 1: 13 (27.7%) 2: 15 (31.9%) 3: 12 (25.5%) 4: 5 (10.6%)	0: 39 (83%) 1: 0 (0%) 2: 2 (4.3%) 3: 3 (6.4%) 4: 2 (4.3%)
Kocaoglu (2022)	NR	NR	NR	Irreparable labrum	IT: 0: 9 (45%) 1: 7 (35%) 2: 4 (20%) TA: 0: 8 (36.4%) 1: 10 (45.4%) 2: 4 (18.2%)	IT: 63.3 (5.6) TA: 63.2 (5.7)	IT: 36.9 (5.9) TA: 37.1 (6.2)	NR	IT: 0: 3 (15.0%) 1: 6 (30.0%) 2: 8 (40.0% 3: 3 (15.0%) TA: 0: 3 (13.6%) 1: 5 (22.7%) 2: 11 (50.0% 3: 3 (13.6%)	IT: 0: 17 (85.0%) 1: 3 (15.0%) TA: 0: 17 (77.3%) 1: 5 (22.7%)
Scanaliato (2022)	NR	NR	Mild Moderate Severe	Irreparable labrum	NR	64.12 (12.9)	NR	33.97 (8.2)	NR	NR
Deng (2021)	NR	Hypoplasia (<5 mm)	n = 14 Could not be repaired by suture intra-operatively	Nonsalvageable, nonexisten bc of significant tearing, degenerative tissue, or hypoplasia	NR	NR	NR	NR	1: 5 (24%) 2: 9 (43%) Type 1: n = 5 Type 2: n = 9	NR

(*continued on next page*)

Table 2 (*continued*)

Author (year)	Labral width (mm)	Definition of labral hypoplasia	Definition of complex tear	Indications for reconstruction, repair or augmentation	Tonnis grade	Alpha angle (SD)	ACEA (SD)	LCEA (SD)	Outerbridge classification score – acetabulum (%)	Outerbridge classification score – femoral head (%)
Kucharik (2021)	NR	<5 mm	NR	Hypoplastic tissue (width <5 mm), complex tearing, or frank degeneration of native tissue	0: 23 (23.7%) 1: 62 (63.9%) 2: 62 (63.9%) 3: 0 (0.0%)	55.4 (range: 52.6–58.2)	NR	36.7 (35.5–37.9)	NR	NR
Maldonado (2020)	NR	NR	NR	Irreparable labrum	Grade 1 or less	59.7 (13.8)	31.7 (9.0)	32.9 (7.0)	0: 1 (2.7%) 1: 6 (16.2%) 2: 13 (35.1%) 3: 7 (18.9%) 4: 10 (27.0%)	0: 33 (89.2%) 1: 0 (0.0%) 2: 0 (0.0%) 3: 3 (8.1%) 4: 1 (2.7%)
Nakashima (2019)	NR	NR	NR	Irreparable labrum	Grade 1 or less 0: 15 (60%) 1: 10 (40%)	66.7 (10.5)	38.9 (7.6)	39.3 (7.3)	NR	NR
Amar (2018)	NR	NR	NR	Irreparable labrum	Grade 1 or less	NR	NR	NR	NR	NR
Carriera (2018)	NR	Hypoplasia <3 mm	None Mild (stable rim configuration with some fraying) Moderate (rim stability and intra-substance damage greater than fraying but still <50% of substance at tear site) Severe (complex, multiplane injury >50% of substance at tear site with or without stability at rim)	Intrasubstance degeneration of over 50% labral substance, hypoplasia, previous labral surgery with deficiency tissue, labral tearing in segment of an os acetabuli, extensive labral bruising, rim ossification, combo	Grade 1: 7/31 (22.6%) Grade 0: 24/31 (77.4%)	NR	NR	NR	NR	NR
Lebus (2018)	NR	Width of 5 mm, and opt to reconstruct when it is less than 3 mm	Tears that completely disrupt the longitudinal fibres of the labrum	Deficient labrum as seen during arthroscopic surgery	NR	Alpha angle ≥55 Recon without reoperation: 186 (79%) Revision arthroscopy needed: 28 (80%) Converted to THA: 32 (76%)	NR	LCEA <25° Recon without reoperation: 17 (7%) Revision arthroscopy needed: 8 (23%) Converted to THA: 9 (21%)	3 or 4: 139 (43%) Grade 3 or 4: 139	Grade 3 or 4: 159 (50%)
Scanaliato (2018)	NR	NR	50% of the labral substance at the site of the tear	Irreparable labrum	0: 47 (74.6%) 1: 8 (12.7%) 2: 8 (12.7%)	NR	NR	NR	NR	NR

(*continued on next page*)

Table 2 (*continued*)

Author (year)	Labral width (mm)	Definition of labral hypoplasia	Definition of complex tear	Indications for reconstruction, repair or augmentation	Tonnis grade	Alpha angle (SD)	ACEA (SD)	LCEA (SD)	Outerbridge classification score – acetabulum (%)	Outerbridge classification score – femoral head (%)
Matsuda (2013)	NR	NR	NR	The labrum was nonsalvageable because of a severe deficiency in quantity (e.g, segmental loss) and/or quality (*eg*, labral ossification)	Grade 1 or less 0: 5 (62.5%) 1: 3 (37.5%)	NR	NR	NR	Mean: 2.75 SD: (0.71) range: 2–4	NR
Sierra (2009)	NR	NR	NR	Degenerated or absent labrum	NR	NR	NR	NR	2: 3 (60%) 4: 2 (40%) Type 2: 3 Type 4: 2	NR
Treatment: augmentation										
Soares (2022)	NR	NR	NR	Insufficient labral tissue	NR	Men: 67 (14) - 39% Women: 61 (16) - 61%	NR	Men: 32 (8) - 39% Women: 31 (5) - 61%	NR	NR
Weidner (2018)	1–2 mm	1–2 mm labrum	NR	The indication for labral augmentation was a thin (1–2 mm) labrum which seemed to provide an insufficient seal without additional augmentation	Grade 1 or less 0: 9 (56.3%) 1: 7 (43.7)	62.5 (12.4)	NR	29 (4.9)	NR	NR
Treatment: repair										
Kaplan (2021)	11:30 (indirect rectus): 7.1 ± 2.2 mm 3:00 (Psoas U): 7.0 ± 2.0 mm 1:30 (point 1⁄2 between): 5.5 ± 1.9 mm	Patients were divided into groups by labral width of < (hypoplastic) and ≥1 SD below the mean	NR	Underwent labral repair	Grade 1 or less	NR	NR	NR	NR	NR
Brinkman (2020)	Mean: 5.35 (1.40) Bottom decile: 3.2 (0.4) Bottom quartile: 3.8 (0.4)	NR	NR	NR	Grade 1 or less	NR	NR	Range: 25-40	NR	NR
Drager (2020)	<4 mm	Labral width <4 mm	NR	Underwent labral repair	Grade 1 or less	Pre-op: 52.1 (12.5) Post-op: 37.4 (3.7)	NR	Pre-op: 29.4 (6.7) Post-op: 28.4 (6.7) p = 0.04	NR	NR

NR = not reported; ACEA = anterior center-edge angle; LCEA = lateral center-edge angle.

Table 3
Labral surgery details.

Author (year)	Graft type (n)	Circumferential vs segmental (n)	Additional procedures, n (%)	Post-op rehab
Treatment: reconstruction				
White (2023)	Frozen fascia lata allograft	Circumferential	NR	30% weight bearing for 4 weeks if no microfracture was performed, 20% if there was. Limited external rotation for 2 weeks. Aspirin and sequential compression devices for DVT prevention, naproxen for HO prophylaxis. Physical therapy begins within 1 week.
Bodendorfer (2022)	SLR: Iliotibial band allograft: 48 Hamstring graft: 2 Alternative graft: 3 CLR: Iliotibial band allograft: 51	Segmental: 53 Circumferential: 51	SLR (%): Femoroplasty: 86.8 Synovectomy: 66.0 Acetabuloplasty 75.5 LT debridement 24.5 Capsular closure 96.2 Capsular release 3.8 Acetabular microfracture 1.9 Loose body removal 11.3 CLR (%): Femoroplasty: 96.1 Synovectomy: 82.4 Acetabuloplasty 56.9 LT debridement 23.5 Capsular closure 100.0 Capsular release 0.0 Acetabular microfracture 2.0 Loose body removal 11.8	Initial joint post-op protection, initial mobility exercises, then stability exercises after increased hip ROM.
Jiminez (2022)	Posterior tibialis Allograft: 43 Autograft: 4	Segmental: 45 Circumferential: 2	Capsular repair: 21 (70%) Femoroplasty: 29 (96.7%) Acetabular microfracture: 3 (10%)	3-month protocol: WBAT, limited flexion and extension for 6 weeks, stationary bicycle use for 8 weeks post-surgery.
Kocaoglu (2022)	Autologous iliotibial band graft (5 mm): 20 Allogeneic tibialis anterior tendon graft (7 mm): 22	Segmental	IT: Cartilage debridement -Femoral head: 3 (15%) Acetabular labral: 11 (55%) Capsule closure: 19 (95%) Combined femoroplasty and acetabuloplasty: 20 (100%) Synovectomy: 1 (5%) TA: Cartilage debridement -Femoral head: 5 (22.7%) Acetabular labral: 14 (63.6%) Capsule closure: 20 (90.9%) Combined femoroplasty and acetabuloplasty: 20 (100%)	Partial weight bearing for 2 weeks, then as tolerated. Physical therapy initiated in the second week and continued for 4–6 weeks.
Scanaliato (2022)	Frozen tensor fascia lata allograft	Circumferential	Cam osteoplasty: 60 (96.8%) Pincer osteoplasty: 46 (74.2%) Acetabular chondroplasty: 56 (88.9%)	Immediate weight bearing and range of motion post-op. Stepwise activity progression: stationary bicycling at 1–2 weeks, with resistance at 4 weeks, light jogging at 12 weeks, full activity at 6 months.
Deng (2021)	Capsule autograft	Segmental	NR	10 kg less weight bearing using a flat-foot gait with crutches for 6 weeks; crutches not needed after 6 months. Swimming at 3 months, golf at 4 months.
Kucharik (2021)	Capsular autograft	Segmental	Acetabuloplasty: 88 (90.7%) Femoroplasty: 42 (43.3%) Microfracture: 2 (2.1%) Removal of fibrocystic lesion: 1 (1.0%) Synovectomy and removal of loose body: 1 (1.0%)	Immediate weight bearing as tolerated with crutches for 6 weeks. Stationary bike use from 6 weeks, swimming/elliptical trainer at 10 weeks, strengthening exercises from 4 months, impact-loading exercises at 6 months.

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Table 3 (*continued*)

Author (year)	Graft type (n)	Circumferential vs segmental (n)	Additional procedures, n (%)	Post-op rehab
Maldonado (2020)	Anterior tibialis allograft	Circumferential	Capsular treatment -Repair: 16 (43.2%) Capsulotomy without repair: 21 (56.8%) Acetabuloplasty: 37 (100%) Femoroplasty: 37 (100%) Acetabular microfracture: 8 (21.6%) Trochanteric bursectomy: 13 (35.1%) Gluteus medius repair: 5 (13.5%) Suture staple: 2 (40%) Transtendinous: 3 (60%)	Reconstruction patients restricted to 20 lb of weight bearing and use of hip brace for 6 weeks. Stationary bike use encouraged from day 1. Follow-ups at 2 weeks, 3 months, and annually.
Nakashima (2019)	Autologous iliotibial band	Segmental	Microfracture: 4 (16%) Joint capsular closure: 25 (100%)	NR
Amar (2018)	Indirect rectus femoris tendon	Segmental	Capsular repair: 8 (X%)	WBAT with follow-ups at 3 weeks, 3 months, 6 months, and yearly.
Carriera (2018)	Fascia lata allograft	Segmental: 31	Femoroplasty: 83.9% Synovectomy: 83.9% Acetabuloplasty 80.6% Acetabular chondroplasty: 48.4% LT debridement 87.1% Capsular closure: 67.8% Capsular release 3.2% Capsular plication 29.0% Acetabular microfracture 29.0% Loose body removal 12.9% Iliopsoas release 6.5% Troch bursectomy: 3.2%	20 lb weight bearing for 4–6 h daily; microfracture protocol: toe-touch weight bearing until 6 weeks. Immediate physical therapy post-surgery.
Lebus (2018)	Autogenous iliotibial band graft	Segmental	Femoral neck osteoplasty (cam FAI): 12 (3.78%) Rim trimming (pincer FAI): 6 (1.89%) Femoral neck osteoplasty + rim trimming (cam + pincer FAI): 293 (92.43%) Arthroscopic bursectomy (trochanteric bursitis): 82 (25.87%) Synovectomy: 301 (94.95%) Lysis of adhesions: 154 (48.58%) Grade III or IV chondral lesions of the acetabulum: 139 (43.85%) Microfracture: 67 (21.14%) Grade III or IV chondral lesions of the femoral head: 159 (50.16%) Microfracture: 17 (5.36%) Femoral neck osteoplasty (cam FAI): 12 (X%) Rim trimming (pincer FAI): 6 (X%) Femoral neck osteoplasty: rim trimming (cam + pincer FAI): 293 (X%) Arthroscopic bursectomy (trochanteric bursitis): 82 (X%) Synovectomy: 301 (X%) Lysis of adhesions: 154 (X%) Grade III or IV chondral lesions of the acetabulum: 139 (X%) Microfracture: 67 (X%) Grade III or IV chondral lesions of the femoral head: 159 (X%) Microfracture:17 (X%)	Standard rehabilitation includes limited weight bearing, hip brace, and antirotation bolster for 21 days. Focus on regaining motion and strength.

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Table 3 (*continued*)

Author (year)	Graft type (n)	Circumferential vs segmental (n)	Additional procedures, n (%)	Post-op rehab
Scanaliato (2018)	Iliotibial band allograft	Circumferential	Osteoplasty -Cam: 61 (96.8%) Pincer: 44 (69.8%) Subspine: 5 (7.9%) Fovea: 2 (3.2%) Chondroplasty -Acetabular: 56 (88.9%) Femoral head: 9 (14.3%) Unspecified: 2 (3.2%) Acetabular microfracture: 1 (1.6%) Excision of acetabular rim fracture: 6 (9.5%) Ligamentum teres debridement: 19 (30.2%) Synovectomy: 38 (60.3%) Capsular plication: 11 (17.5%) Loose body removal) 6 (9.5 Drilling of subchondral cyst: 1 (1.6) Trochanteric bursectomy: 10 (15.9) Repair of gluteus medius and/or minimus tear: 3 (4.8) Lesser trochanter osteoplasty: 1 (1.6) The capsule was either repaired or plicated in all patients in this study	Post-op passive motion begins immediately. Protected weight bearing with crutches until normal gait is achieved (2–4 weeks post-op).
Matsuda (2013)	Gracilis Autograft	Segmental	Arthroscopic femoroplasty was performed to eradicate cam impingement, which can cause ongoing symptoms/degeneration and early mechanical failure of the reconstructed labrum.	Low-resistance cycling exercises from postoperative day 1, crutch-protected ambulation for 2 weeks, pool jogging/swimming once incisions healed, elliptical trainer at 4 weeks, running/jumping at 12 weeks.
Sierra (2009)	ligamentum teres capitis	Segmental	Femoral head offset correction: 3 (60%) Acetabular trimming: 3 (60%) Femoral head microfracture: 1 (20%) Global rim trimming: 2 (40%)	Post-surgery, patients had six weeks of restricted movement, weight-bearing limitations until week eight, and used a passive motion machine and began low-resistance cycling in week two. Evaluations at 2, 4 months, and annually included clinical exams, UCLA score, and radiographs. Selective MRIs assessed labrum healing.
Treatment: augmentation				
Soares (2022)	Iliotibial graft Autografts: 39 Allografts: 38	Segmental	Debridement, microfracture, adhesions removal as needed Capsular closure: 88 (100%) Capsular reconstruction: 2 (22.7%X%)	Post-op circumduction exercises to prevent adhesion. Weight bearing limited to 20–30 pounds using crutches for 3–6 weeks. Rehabilitation includes strengthening and functional training.
Weidner (2018)	Ligamentum teres autograft	Segmental	Screw removal at the greater trochanter: 3 (18.8X %) Additional hip arthroscopy for removal of intra articular adhesions (1y post-op): 1 (6.3X%)	Postoperative protocol involved partial weight bearing (15 kg) for 4 weeks, gradually increasing thereafter. Movement was initially limited to 90° flexion, 20° internal and external rotation, and gradually expanded. A continuous passive motion machine was used from day one, and regular stationary bike usage began after hospital discharge during the initial 6 weeks.
Treatment: repair				
Kaplan (2021)	NR	Segmental	Capsular repair: 9 (8.73X%) Osteoplasty if indicated	Patients given aspirin for DVT prophylaxis and Celecoxib for HO prophylaxis. Weight bearing with 2 crutches for 4 weeks. Use of abduction brace for one week post-surgery.

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Table 3 (*continued*)

Author (year)	Graft type (n)	Circumferential vs segmental (n)	Additional procedures, n (%)	Post-op rehab
Brinkman (2020)	NR	Segmental	Cam and pincer lesions were corrected when present. Psoas release was performed for patients with reproducible painful iliopsoas snapping. Ligamentum teres tears were addressed with radiofrequency debridement. Capsular repair was performed using a standard technique. The decision for capsular repair was based on the surgeon's assessment of patient factors, ease of femoral head subluxation, and intraoperative laxity.	Passive motion started at week 0, and patients used crutches with flat-foot partial weight bearing for 2 weeks. Patients then progressed through institutional protocols, with jogging exercises beginning at 3 months and return to sport at 5–6 months.
Drager (2020)	NR	Segmental	Acetabular rim decortication: 173 (100%) Femoral osteochondroplasty: 173 (100%) Capsular closure: 173 (100%) Removal of loose body: 0 (0%) Trochanteric bursectomy: 7 (4.0%) Microfracture: 1 (0.6%)	The 16–18 week postoperative rehab program consists of four phases: Phase 1 (3–4 weeks) emphasizes joint protection and limited weight-bearing. Phase 2 (4–6 weeks) restores normal gait, range of motion, and core stability. Phase 3 (4–6 weeks) incorporates strength training and cardiovascular fitness. Phase 4 targets return to pre-injury sports levels, with running and sport-specific activities by week 16.

also showed significant improvement in postoperative PROMs. Furthermore, this review found the percentage of conversion and revision of those who had an autograft was higher compared to the use of an allograft. Similarly, rates of conversion and revision were higher in those receiving segmental over circumferential reconstruction.

Patients with labral hypoplasia who underwent repair have improved postoperative PROMs. Some of these studies also compared PROMs for repairs done in hypoplastic labra versus non-hypoplastic labra [1,42,43]. There were some differences noted between studies, with one study demonstrating superior results in the non-hypoplastic group. However, two other studies found that there was no statistical difference in outcomes of repair between hypoplastic and non-hypoplastic labra. The contradiction of the studies could be explained by the way in which the labral size was determined. In the study by Kaplan et al., the labral size was determined via pre-operative MRI with no mention of intraoperative findings for comparison [42]. Whereas, Brinkman et al. and Drager et al. both used intraoperative measurements [1,43]. Of the patients who had a repair, only one required conversion to THA [42].

Some of the findings from this review diverge from previously published literature. The conversion rate to THA and revision rates (6.6% and 5.9%) were noted to be slightly increased compared to previous literature which showed conversion and revision rates of 5.7% and 3.8%, respectively [20]. Additionally, autografts were predominantly used over allografts (54.9% vs 45.1%). This is in contrast to other studies that predominantly used allografts [20,47]. Allograft usage avoids donor site morbidity, as well as decreases surgical time and avoids the variability in graft quality that may come from autograft [20]. However, Maldonado et al. noted that cost and availability are considered limitations to allograft use [48]. It has been shown that procedures done with autograft have lower revision and conversion rates [11]. This, however, is also contradictory to the results from this review which showed increased conversion and revision with autograft [11]. One possible reason for this difference could be that autograft usage has historically been lower compared to allograft usage, therefore conversion and revision rates were consequently lower [11]. Another possible reason could be that the study demonstrating worse outcomes with autografts had a significantly higher follow-up time for the autograft group than allograft group [11].

The introduction of labral reconstruction and augmentation has provided promising options for patients with irreparable hip labra. For labral reconstruction, it is becoming the preferred option in primary irreparable labra, with studies showing lower revision rates and more predictable patient outcomes compared to repair [49]. Another topic of debate in the current literature is whether to reconstruct segmentally or circumferentially. In our review, both techniques gave satisfactory outcomes, which is supported by Orner et al. [50]. Circumferential reconstruction theoretically minimises the weak junctional point between graft and native tissue [51]. A relatively new technique for management of the irreparable labrum is labralisation, which involves undermining the articular cartilage creating a pseudo-labrum, thereby negating the need for a graft [32]. Labral augmentation techniques have also had recent consideration in the literature. Tissue metaplasia is the mechanism by which labral augmentation with allograft and autograft gains a blood supply. However, this may lead to inadequate graft integration [52]. A technique of local capsular transfer to augment the native labrum can potentially increase healing as it already has a blood supply [53].

Overall, this review provides clinicians with a contemporary review of the treatment options and respective outcomes for irreparable and hypoplastic labra. It also demonstrates that a diagnosis of a labral tear in the setting of labral hypoplasia does not necessarily equate to immediate reconstruction as a form of treatment given the positive outcomes of a primary repair.

Limitations of this review include the concern with several studies not distinguishing between hypoplastic labra and other indications for labral treatment such as underlying or associated conditions. In addition, the small number of studies looking specifically at hypoplasia is more limited than other areas in hip preservation surgery. Also, there was a shorter

Table 4
Outcomes - Irreparable (Hypoplastic, Complex tears, Calcified) Labra.

Author (year)	Mean mHHS (SD)	Mean NAHS (SD)	Mean HOS-SSS (SD)	Mean iHOT-12 (SD)	Mean HOS-ADL (SD)	Mean VAS (SD)	Conversion to THA (n, %)	Complications
Treatment: reconstruction								
White (2023)	Pre-op: 50.26 (16.38) Post-op: 84.7 (17.7) Change: 34.45 (20.64) p ≤ 0.001	NR	NR	NR	NR	VAS at rest: Pre-op: 4.73 (2.18) Post-op: 2 (1.87) Change: −2.71 (2.1) p ≤ 0.001 VAS with ADLs: Pre-op: 6.27 (2.09) Post-op: 2.56 (2.37) Change: −3.71 (2.41) p ≤ 0.001 VAS with sport: Pre-op: 7.81 (1.56) Post-op: 3.38 (2.61) Change: −4.53 (2.33) p ≤ 0.001	1 (2%)	1 patient failed, converted to THA.
Bodendorfer (2022)	SLR: Pre-op; 59.3 (15.8) Post-op: 81.8 (16.7) Change: 22.9 (20.0) CLR: Pre-op: 65.4 (14.2) Post-op: 83.6 (14.6) Change: 17.0 (18.8)	NR	SLR: Pre-op; 44.5 (24.6) Post-op: 77.1 (22.1) Change: 32.6 (28.8) CLR: Pre-op: 41.6 (22.8) Post-op: 76.9 (26.5) Change: 36.6 (25.3)	SLR: Pre-op; 33.3 (18.2) post-op: 69.0 (25.8) Change: 35.7 (30.3) CLR: Pre-op: 39.8 (18.4) Post-op: 73.6 (26.2) Change: 33.8 (27.2)	SLR: Pre-op; 61.9 (20.4) Post-op: 77.1 (22.1) Change: 24.8 (24.4) CLR: Pre-op: 69.8 (17.0) Post-op: 88.4 (14.3) Change: 19.0 (17.7)	SLR: Pre-op: 48.1 (23.6) Post-op: 19.9 (19.4) Change: −28.1 (25.6) CLR: Pre-op: 47.4 (20.9) Post-op: 19.3 (19.0) Change: −28.1 (26.5)	SLR: n = 1 (1.98%) CLR: n = 2 (3.92%)	In the LR group, one each required hip revision, THA, and periacetabular osteotomy. In the CLR group, two needed THA, and one required a revision for labral tearing.
Jimenez (2022)	Pre-op: 58.2 (12.3) Post-op: 76.2 (18.4) Change: 17.4 (20.8) p < 0.001	Pre-op: 56.3 (13.5) Post-op: 74.8 (18.4) Change: 16.7 (18.1) p < 0.001	Pre-op: 31.3 (17.3) Post-op: 56.4 (25.7) Change: 24.3 (27.4) p < 0.001	NR	NR	Pre-op: 5.8 (2.0) Post-op: 3.5 (2.4) Change: 2.3 (2.8) p < 0.001	1 (3.3%)	1 patient converted to THA, only as reported in the propensity matched group.
Kocaoglu (2022)	IT: Pre-op: 51 (9.8) Post-op: 82.7 (5.44) p < 0.001 TA: Pre-op: 50.3 (7.19) Post-op: 83.3 (6.15) p < 0.001	IT: Pre-op: 48.2 (9.06) Post-op: 81.1 (5.12) p < 0.001 TA: Pre-op: 50.9 (6.62) Post-op: 82.2 (4.95) p < 0.001	IT: Pre-op: 49.7 (8.46) Post-op: 81.6 (6.18) p < 0.001 TA: Pre-op: 50 (6.09) Post-op: 82.5 (4.4) p < 0.001	NR	NR	IT: Pre-op: 7.8 (0.75) Post-op: 2.1 (0.79) p < 0.001 TA: Pre-op: 7.6 (0.73) Post-op: 1.9 (0.84) p < 0.001	0 (0%)	NR
Scanaliato (2022)	Pre-op: 58.85 (17.4) Post-op: 86.28 (16.2) Change: 27.43 (15.7) p = 0.04 *compared to labral repair	NR	NR	Pre-op: 32.84 (13.5) Post-op: 79.52 (18.3) Change: 46.68 (17.4)	NR	Pre-op: 47.67 (17.1) Post-op: 26.07 (16.8) Change: −21.6 (14.2)	1 (1.61%)	Revision arthroscopy in 3 (4.84%) patients.
Deng (2021)	Pre-op: 61.3 (5.5) Post-op: 87.5 (4.2) p < 0.05	NR	NR	NR	Pre-op: 48.5 (5.8) Post-op: 75.2 (3.5)	NR	NR	None
Kucharik (2021)	Pre-op: 61.5 (range: 58.7–64.3) Post-op: 84.6 (range: 81.8–87.4) p < 0.001	NR	Pre-op: 43.3 (range: 38.3–48.4) Post-op: 75.8 (range: 71.0–80.6) p = 0.000	iHOT-33 Pre-op: 40.4 (36.7–44.2) Post-op: 76.6 (72.4–80.8) p = 0.000	Pre-op: 71.3 (range: 67.3–75.2) Post-op: 89.9 (range: 87.6–92.1) p = 0.000	NR	0 (0%)	Heterotopic ossification: 6 (6.2%) Transient neurapraxia –pudendal: 1 (1%) Transient neurapraxia - peroneal: 1 (1%)

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Table 4 (*continued*)

Author (year)	Mean mHHS (SD)	Mean NAHS (SD)	Mean HOS-SSS (SD)	Mean iHOT-12 (SD)	Mean HOS-ADL (SD)	Mean VAS (SD)	Conversion to THA (n, %)	Complications
Maldonado (2020)	Pre-op: 62.9 (15.1) Post-op: 86.7 (18.4) Change: 23.1 (16.4) $p < 0.0001$	Pre-op: 60.5 (16.3) Post-op: 86.2 (18.6) Change: 24.2 (15.4) $p < 0.0001$	Pre-op: 38.7 (25.1) Post-op: 78.4 (27.9) Change: 37.8 (21.1) $p < 0.0001$	Pre-op: 34.9 (21.7) Post-op: 77 (28) Change: 41.3 (24.2) $p < 0.0001$	NR	Pre-op: 5.1 (2.1) Post-op: 2 (2.5) Change: −2.9 (2.6) $p < 0.0001$	2 (5.4%)	NR
Nakashima (2019)	Pre-op: 67.3 (14.9) Post-op: 95.0 (8.1) $p < 0.001$	Pre-op: 63.0 (18.3) Post-op: 89.5 (10.1) $p < 0.001$	NR	NR	NR	NR	3 (12%)	Revision arthroscopy: 3 (12.0%)
Amar (2018)	Median preop: 67.1 (range: 49.5–82.5) Median postop: 97.8 (range: 73.7–100) Median change: 29.0 (range: 11–47.3) $p < 0.0001$	NR	NR	NR	NR	NR	2 (9.09%)	NR
Carriera (2018)	Pre-op: 64.0 (20.2) Post-op: 84.6 (19.5) $p < 0.0001$	NR	Pre-op: 32.9 (28.9) Post-op: 65.7 (35.5) $p < 0.0001$	Pre-op: 36.4 (19.8) Post-op: 68.1 (28.4) $p = 0.0017$	Pre-op: 62.6 (20.1) Post-op: 81.6 (22.2) $p = 0.0032$	NR	4 (12.9%)	One patient had a superficial portal infection, which resolved with oral antibiotics and local wound care.
Lebus (2018)	Pre-op: 65 (range: 53–81) Post-op: 85 (range: 63–92) $p < 0.001$	NR	Pre-op: 47 (range: 28–66) Post-op: 75 (range: 50–94) $p < 0.001$	NR	Pre-op: 71 (range: 56–81) Post-op: 90 (range: 76–96) $p < 0.001$	NR	42 (13.2%)	42 patients were converted to THA (13.2%) and 35 required revision arthroscopic surgery after labral reconstruction (11.0%)
Scanaliato (2018)	Pre-op: 60.2 (15.5) Post-op: 80.7 (16.4) Change: 20.4 $p < 0.01$	NR	NR	Pre-op: 37.8 (19.7) Post-op: 65.8 (26.2) Change: 27.8 $p < 0.01$	NR	Pre-op: 49.9 (21.7) Post-op: 23.6 (22.5) Change: −25.6 $p < 0.01$	2 (3%)	5 (8.1X%) failed treatment 3 (4.8X%) labral reconstruction hips required revision arthroscopic treatment
Matsuda (2013)	NR	Pre-op: 41.88 (14.30) Post-op: 92.38 (5.93) Change: 50.50 (18.85) $p = 0.008$	NR	NR	NR	NR	0 (0%)	Two patients who underwent labral reconstruction experienced temporary pudendal nerve neurapraxias, which fully resolved in 3 months. One of these cases involved a patient with protrusio acetabuli requiring complex hip distraction, while the other patient had simultaneous bilateral surgeries.
Treatment: augmentation								
Soares (2022)	Pre-op: 58 (15) Post-op: 80 (20) $p < 0.01$	NR	Pre-op: 40 (21) Post-op: 73 (29) $p < 0.01$	NR	Pre-op: 63 (17) Post-op: 84 (18) $p < 0.01$	NR	5 (6.5%)	Eleven patients (14%) required repeat revision hip arthroscopy surgery.

mHHS = modified Harris hip score; NAHS = non-arthritic hip score; HOS-SSS = hip outcome score - sport specific subscale; iHOT-12 = international hip outcome tool - 12; HOS-ADL = hip outcome score - activities of daily living; VAS = visual analog scale; THA = total hip replacement.

Table 5
Outcomes - hypoplastic labra.

Author (year)	Mean mHHS (SD)	Mean iHOT-12 (SD)	Mean VAS (SD)	Mean OHS (SD)	Mean UCLA (SD)	Conversion to THA (n, %)	Complications
Treatment: reconstruction							
Sierra (2009)	NR	NR	NR	NR	Pre-op: 5 (range: 2–6) Post-op: 8.2 (range: 6–10) Change: 3.2	1 (20%)	None
Treatment: augmentation							
Weidner (2018)	NR	NR	NR	1 year Postop: 42 (9.1)	NR	NR	Screw removal at the greater trochanter: 3 Additional hip arthroscopy for removal of intraarticular adhesions (1y post-op):
Treatment: repair							
Kaplan (2021)	Indirect Rectus (12:00) Position -≥ 4.9 mm: Pre-op: 48.2 Post-op: 87.1 <4.9 mm: Pre-op: 49.6 Post-op: 69.1 $p < 0.001$ Psoas U (3:30) Position -≥ 5.0 mm: Pre-op: 48.8 Post-op: 87.0 <5.0 mm: Pre-op: 46.1 Post-op: 69.7 $p < 0.001$ Anterosuperior (1:30) Position -≥ 3.6 mm: Pre-op: 48.7 Post-op: 87.3 <3.6 mm: Pre-op: 47.0 Post-op: 71.0 $p < 0.001$	NR	NR	NR	NR	1 (1%)	Four patients underwent further ipsilateral hip surgery, meeting the failure criteria. Among them, one patient with universally hypoplastic labrum proceeded to THA, another with the same condition required a revision scope. Two more patients, one with universally hypoplastic labrum and another with hypoplasia only at the anterosuperior position, also needed revision scopes.
Brinkman (2020)	Bottom decile: Change: 26.2 (19.7) Bottom quartile: Change: 20.7 (17.2) $p > 0.05$	Bottom decile: Change: 41.9 (18.1) Bottom quartile: Change: 38.7 (23.7) $p > 0.05$	NR	NR	NR	NR	revision required: Bottom decile: n = 2 (6.1%) Bottom quartile: n = 8 (7.3%)
Drager (2020)	Pre-op: 58.8 (13.8) Post-op: 84.3 (17.0) Change: 24.1 (16.6) $p > 0.05$	Pre-op: 33.7 (18.1) Post-op: 75.1 (24.3) Change: 39.4 (26.3) $p > 0.05$	Pre-op: 53.4 (21.8) Post-op: 18.7 (22.2) Change: −34.5 (27.3) $p > 0.05$	NR	NR	0 (0%)	postoperative pulmonary embolus: 1 deep vein thrombosis: 1 transient neuralgia in the affected lower extremity: 3 Labrum retear: 1

mHHS: Modified Harris Hip Score; iHOT-12 = international hip outcome tool - 12; VAS = visual analog scale; OHS = Oxford hip score; UCLA = University of California Los Angeles; THA = total hip replacement.

follow-up period in the hypoplastic group than the irreparable group which clearly limits the comments about survivorship. Finally, the results were heterogeneous precluding pooling of the data as most studies were of fair to good methodological quality though observational in design. Future studies should stratify outcomes based on the specific labral pathology as well as underlying conditions treated concurrently to enable a clearer delineation of postoperative outcomes.

CONCLUSION

The findings of this review suggest that treatment of the irreparable labral with reconstruction or augmentation results in improved PROMs. For the hypoplastic labrum, primary repair also results in improvement in PROMs. Future studies focusing on the hypoplastic labra alone with an appropriate control group, rather than irreparable labral tears are needed to properly assess patient outcomes and guide surgical indications.

Ethics

No ethical approval was required for this review.

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Study approval

No study approval was required for this review.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Olufemi R. Ayeni reports a relationship with Journal of International Society of Arthroscopy Knee Surgery and Orthopaedic Sports Medicine that includes: board membership. Olufemi R. Ayeni reports a relationship with Tier 2 Canada Research Chair in Joint Preservation that includes: board membership. Nicole Simunovic reports a relationship with Journal of International Society of Arthroscopy Knee Surgery and Orthopaedic Sports Medicine that includes: board membership. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Not Applicable.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jisako.2024.04.012.

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