Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

- **Refractive Surgery**
  - **Intraocular**
    - Pseudophakic
      - Refractive lens exchange (RLE)
    - Phakic IOL
      - Iris-fixated
      - Sulcus-fixated
  - **Corneal**
    - Incisional
      - RK
      - AK
      - LRI
    - Laser
      - PRK
      - LASEK
      - Epi-LASIK
      - LASIK
      - SMILE
  - Other
    - CK
    - SAI
    - CRI
    - CXL
    - ICRS
What does CK stand for?
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular
- Pseudophakic
- Phakic IOL
  - Iris-fixated
  - Sulcus-fixated

Corneal
- Incisional
  - RK
  - AK
  - LRI
- Laser
  - PRK
  - LASEK
  - Epi-LASIK
  - LASIK
  - SMILE
- Other
  - CK
  - SAI
  - CRI
  - CXL
  - ICRS

What does CK stand for? Conductive Keratoplasty
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

Pseudophakic
- Refractive lens exchange (RLE)

Phakic IOL
- Iris-fixated
- Sulcus-fixated

Corneal

Incisional
- RK
- AK
- LRI

Laser
- PRK
- LASEK
- Epi-LASIK
- LASIK
- SMILE

Other
- CK
- SAI?
- CRI
- CXL
- ICRS

What does **CK** stand for?
- Conductive Keratoplasty

What does **SAI** stand for?
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular
- Pseudophakic
  - Refractive lens exchange (RLE)
- Phakic IOL
  - Iris-fixated
  - Sulcus-fixated

Corneal
- Incisional
  - RK
  - AK
  - LRI
- Laser
  - PRK
  - LASEK
  - Epi-LASIK
  - LASIK
  - SMILE
- Other
  - CK
  - SAI
  - CRI
  - CXL
  - CXL

What does CK stand for?
Conductive Keratoplasty

What does SAI stand for?
Small Aperture Inlay
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

Pseudophakic
  Refractive lens exchange (RLE)

Phakic IOL
  Iris-fixated
  Sulcus-fixated

Corneal

Incisional
  RK
  AK
  LRI

Laser
  PRK
  LASEK
  Epi-LASIK
  LASIK
  SMILE

Other
  CK
  SAI
  CRI
  CXL
  ICRS

What does CK stand for? Conductive Keratoplasty

What does SAI stand for? Small Aperture Inlay

What does CRI stand for?
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular
- Pseudophakic
- Phakic IOL

Corneal
- Incisional
  - RK
  - AK
  - LRI
- Laser
  - PRK
  - LASEK
  - Epi-LASIK
  - LASIK
  - SMILE
- Other
  - CK
  - SAI
  - CRI
  - CXL
  - ICRS

What does **CK** stand for? Conductive Keratoplasty

What does **SAI** stand for? Small Aperture Inlay

What does **CRI** stand for? Corneal Reshaping Inlay
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular
- Pseudophakic
  - Refractive lens exchange (RLE)
- Phakic IOL
  - Iris-fixated
  - Sulcus-fixated

Corneal
- Incisional
  - RK
  - AK
  - LRI
- Laser
  - PRK
  - LASEK
  - Epi-LASIK
  - LASIK
  - SMILE
- Other
  - CK
  - SAI
  - CRI
  - CXL?

What does CK stand for? Conductive Keratoplasty

What does CXL stand for? Corneal Reshaping Inlay

What does SAI stand for? Small Aperture Inlay
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

- Pseudophakic
  - Refractive lens exchange (RLE)
- Phakic IOL
  - Iris-fixated
  - Sulcus-fixated

Corneal

- Incisional
  - RK
  - AK
  - LRI
- Laser
  - PRK
  - LASEK
  - Epi-LASIK
  - LASIK
  - SMILE

Other

- CK
- SAI
- CRI
- CXL
- ICRS

What does **CK** stand for?
Conductive Keratoplasty

What does **CXL** stand for?
Corneal CROSS Linking

What does **CRI** stand for?
Corneal Reshaping Inlay

What does **SAI** stand for?
Small Aperture Inlay
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular
- Pseudophakic
  - Refractive lens exchange (RLE)
- Phakic IOL
  - Iris-fixated
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Corneal
- Incisional
  - RK
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  - LRI
- Laser
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- Other
  - CK
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  - CRI
  - CXL
  - ICRS?

What does CK stand for? **Conductive Keratoplasty**
What does CXL stand for? **Corneal CROSS Linking**
What does CRI stand for? **Corneal Reshaping Inlay**

What does SAI stand for? **Small Aperture Inlay**
What does ICRS stand for?
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

- Pseudophakic
  - Refractive lens exchange (RLE)
- Phakic IOL
  - Iris-fixated
  - Sulcus-fixated

Corneal

- Incisional
  - RK
  - AK
  - LRI
- Laser
  - PRK
  - LASEK
  - Epi-LASIK
  - LASIK
  - SMILE
- Other
  - CK
  - SAI
  - CRI
  - CXL
  - CRLS

What does CK stand for?
Conductive Keratoplasty

What does CXL stand for?
Corneal CROSS Linking

What does CRI stand for?
Corneal Reshaping Inlay

What does SAI stand for?
Small Aperture Inlay

What does ICRS stand for?
Intrastromal Corneal Ring Segments
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

Pseudophakic

Phakic IOL

Incisional

Laser

Corneal

Refractive lens exchange (RLE)

Other

CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities?

CK
SAI
CRI
CXL
ICRS
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular
- Pseudophakic
- Phakic IOL
- Refractive lens exchange

Corneal
- Incisional
- Laser
  - RK
  - PRK

Other
- LASIK
- SMILE
- CXL
- CK
- SAI
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- ICRS

CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities?
CK, SAI and CRI are used to treat presbyopia, whereas CXL and ICRS are primarily used to treat keratoconus.
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular
- Pseudophakic
  - Refractive lens exchange (RLE)
- Phakic IOL

Corneal
- Incisional
  - RK
- Laser
  - LASIK
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Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular
- Pseudophakic
- Phakic IOL

Corneal
- Incisional
- Laser
- Other
  - RK
  - PRK
  - LASIK

Other
- CXL
- SAI
- CRI

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CK, SAI and CRI are used to treat \textit{presbyopia}, whereas CXL and ICRS are primarily used to treat \textit{keratoconus}

\begin{itemize}
  \item \textbf{CK} is performed by inserting a thin probe into the corneal stroma and running energy through the probe's tip. This energy heats the adjacent stromal tissue, resulting in collagen shrinkage.
  \item How does collagen shrinkage treat \textit{presbyopia}?
    \begin{itemize}
      \item Each area of shrinkage causes localized flattening of the cornea.
      \item By placing a number of such spots in a ring (more than one ring may be needed) in the corneal periphery, the peripheral cornea flattens, which in turn produces central corneal steepening.
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Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Corneal

Intraocular

Pseudophakic

Phakic IOL

Incisional

Laser

Other

Refractive lens exchange (RLE)

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Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

Pseudophakic

Phakic IOL

Incisional

Laser

Corneal

Sulcus-fixated

Refractive lens exchange (RLE)

Iris-fixated

Pseudophakic

Phakic IOL

RK

PPK

Other

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Is CK typically performed unilaterally, or bilaterally?
Unilaterally

CK, SAI, CRI, CXL
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Unilaterally

Is it usually performed on the dominant, or nondominant eye?
Nondominant
Refractive Surgery

Intraocular

Pseudophakic

Phakic IOL

Incisional

Laser

Corneal

Sulcus-fixated

Refractive lens exchange (RLE)

Other

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Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

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Nondominant

How much myopic shift are we talking about here?
Usually 1-2D
Refractive Surgery

Intraocular

Pseudophakic

Phakic IOL

Incisional

Laser

Corneal

Sulcus-fixated

Refractive lens exchange (RLE)

RK

Lasek

PRK

LRI

SMILE

Epi-LASIK

Other

Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

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Is CK typically performed **unilaterally**, or **bilaterally**?
Unilaterally

Is it usually performed on the dominant, or nondominant eye?
Nondominant

How much myopic shift are we talking about here?
Usually 1-2D
Is CK a safe procedure? Yes. Serious complications are rare.

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**Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery**

Refractive Surgery

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How much myopic shift are we talking about here?
Usually 1-2D

Is CK, SAI and CRI used for the treatment of presbyopia, whereas CXL and ICRS are primarily used to treat keratoconus.

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What are these respective commonalities?
CK, SAI and CRI are used to treat **presbyopia**, whereas CXL and ICRS are primarily used to treat **keratoconus**.

Is CK a safe procedure?
Yes. Serious complications are rare.

What is the biggest drawback to CK?
Regression. Long-term studies indicate that a significant proportion of eyes will lose much (if not all) of the treatment effect over time.

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Unilaterally

Is it usually performed on the dominant, or nondominant eye?
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Refractive Surgery

Corneal

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What are these respective commonalities? CK, SAI and CRI are used to treat presbyopia, whereas CXL and ICRS are primarily used to treat keratoconus.

Is CK typically performed unilaterally, or bilaterally? Unilaterally.

Is it usually performed on the dominant, or nondominant eye? Nondominant.

How much myopic shift are we talking about here? Usually 1-2D.
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

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How much myopic shift are we talking about here? Usually 1-2D
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

- Pseudophakic
- Phakic IOL

Corneal

- Incisional
- Laser
- Other

Other

CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities?

CK, SAI and CRI are used to treat **presbyopia**, whereas CXL and ICRS are primarily used to treat **keratoconus**

How is SAI performed?

A femtosecond laser is used to create a pocket in the central cornea at a depth of about 200 μm. The SAI is then placed in the pocket, making sure that its aperture is centered on the line of sight.

How does an SAI treat presbyopia?

The central aperture of the inlay is only 1.6 mm; thus, it produces a 'pinhole effect.' This dramatically increases the depth-of-focus of the eye, thus allowing the eye to see at near with affecting distance vision.

As of this writing, only one SAI is FDA approved. What is the name of this device?

The KAMRA corneal inlay
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

Corneal

Pseudophakic

Phakic IOL

Incisional

Laser

Other

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How is SAI performed?

A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 200 μm. The SAI is then placed under the flap/in the pocket, making sure that its aperture is centered on the line of sight.
Refractive Surgery

Corneal

Incisional

Laser PRK LASEK 32

Iris-fixated

Intraocular

Pseudophakic

Phakic IOL

Incisional

Sulcus-fixated

Refractive lens exchange (RLE)

CXL

SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities? CK, SAI and CRI are used to treat presbyopia, whereas CXL and ICRS are primarily used to treat keratoconus.

How is SAI performed?
A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 200 μm. The SAI is then placed under the flap/in the pocket, making sure that its aperture is centered on the line of sight.

What does the SAI look like?
Like an opaque ring with a central open aperture.
CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities? CK, SAI and CRI are used to treat presbyopia, whereas CXL and ICRS are primarily used to treat keratoconus.

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What does the SAI look like?
Like an opaque ring with a central open aperture.
Refractive Surgery

Corneal

Intraocular

Pseudophakic

Phakic IOL

Incisional

Laser

Corneal

Sulcus-fixated

Refractive lens exchange (RLE)

LASIK

Epi-LASIK

Other

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How is SAI performed?
A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 200 μm. The SAI is then placed under the flap/in the pocket, making sure that its aperture is centered on the line of sight.

How does an SAI treat presbyopia?
The central aperture of the inlay is only 1.6 mm; thus, it produces a ‘pinhole effect.’ This dramatically increases the depth-of-focus of the eye, thus allowing the eye to see at near without affecting distance vision.
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

Pseudophakic

Phakic IOL

Incisional

Laser

Corneal

RK

RRK

Sulcus-fixated

Refractive lens exchange (RLE)

Corneal Incisional Laser

PRK

LASEK

LASIK

Other

CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities?

CK, SAI and CRI are used to treat presbyopia, whereas CXL and ICRS are primarily used to treat keratoconus.

How is SAI performed?
A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 200 \( \mu \)m. The SAI is then placed under the flap/in the pocket, making sure that its aperture is centered on the line of sight.

How does an SAI treat presbyopia?
The diameter of the central aperture is only 1.6 mm; thus, it produces a ‘pinhole effect.’ This dramatically increases the depth-of-focus of the eye, thus allowing the eye to see at near with affecting distance vision.
How is SAI performed?
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The diameter of the central aperture is only 1.6 mm; thus, it produces a ‘pinhole effect.’ This dramatically increases the depth-of-focus of the eye, thus allowing the eye to see at near with affecting distance vision.

As of this writing, only one SAI is FDA approved. What is the name of this device?
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

How is SAI performed?
A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 200 μm. The SAI is then placed under the flap/in the pocket, making sure that its aperture is centered on the line of sight.

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The diameter of the central aperture is only 1.6 mm; thus, it produces a ‘pinhole effect.’ This dramatically increases the depth-of-focus of the eye, thus allowing the eye to see at near with affecting distance vision.

As of this writing, only one SAI is FDA approved. What is the name of this device?
The KAMRA corneal inlay
Refractive Surgery

Intraocular

Pseudophakic

Phakic IOL

Corneal

Incisional

Laser

Other

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How is SAI performed?

A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 200 μm. The SAI is then placed under the flap/in the pocket, making sure that its aperture is centered on the line of sight.

How does an SAI treat presbyopia?

The diameter of the central aperture is only 1.6 mm; thus, it produces a 'pinhole effect.' This dramatically increases the depth-of-focus of the eye, thus allowing the eye to see at near with affecting distance vision.

As of this writing, only one SAI is FDA approved. What is the name of this device?
The KAMRA corneal inlay
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

**Refractive Surgery**

- **Intraocular**
  - Pseudophakic
  - Phakic IOL
- **Corneal**
  - Incisional
  - Laser
  - Other

CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities?

**SAI** and CRI are used to treat **presbyopia**, whereas CXL and ICRS are primarily used to treat **keratoconus**.

How is SAI performed?

A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 200 μm. The SAI is then placed under the flap/in the pocket, making sure that its aperture is centered on the line of sight.

How does an SAI treat presbyopia?

The diameter of the central aperture is only 1.6 mm; thus, it produces a 'pinhole effect.' This dramatically increases the depth-of-focus of the eye, thus allowing the eye to see at near with almost no affecting distance vision.

As of this writing, only one SAI is FDA approved. What is the name of this device?

The KAMRA corneal inlay

Is SAI typically performed unilaterally, or bilaterally?

Unilaterally
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

Pseudophakic

Phakic IOL

Incisional

Laser

Corneal

Corneal Incisional Laser

PRK

LASEK

RK

AK

LRI

Refractive lens exchange (RLE)

LASIK

SMILE

Epi-LASIK

Other

CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities?

SAI and CRI are used to treat presbyopia, whereas CXL and ICRS are primarily used to treat keratoconus.

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How is SAI performed?

A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 200 μm. The SAI is then placed under the flap/in the pocket, making sure that its aperture is centered on the line of sight.

How does an SAI treat presbyopia?

The diameter of the central aperture is only 1.6 mm; thus, it produces a 'pinhole effect.' This dramatically increases the depth-of-focus of the eye, thus allowing the eye to see at near without affecting distance vision.

As of this writing, only one SAI is FDA approved. What is the name of this device?
The KAMRA corneal inlay.

Is SAI typically performed unilaterally, or bilaterally?

Unilaterally

Is it usually performed on the dominant, or nondominant eye?

Nondominant

None.

SAI do not change the refractive status of the eye!
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities?

CK, SAI and CRI are used to treat presbyopia, whereas CXL and ICRS are primarily used to treat keratoconus.

How is SAI performed?
A femtosecond laser is used to create a flap or pocket in the central cornea about 200 µm deep. The SAI is then placed under the flap/in the pocket, making sure that its aperture is centered on the line of sight.

How does an SAI treat presbyopia?
The diameter of the central aperture is only 1.6 mm; thus, it produces a 'pinhole effect.' This dramatically increases the depth-of-focus of the eye, allowing the eye to see at near without affecting distance vision.

As of this writing, only one SAI is FDA approved. What is the name of this device?
The KAMRA corneal inlay.
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

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A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 200 μm. The SAI is then placed under the flap/in the pocket, making sure that its aperture is centered on the line of sight.

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The diameter of the central aperture is only 1.6 mm; thus, it produces a 'pinhole effect.' This dramatically increases the depth-of-focus of the eye, thus allowing the eye to see at near with affecting distance vision.

As of this writing, only one SAI is FDA approved. What is the name of this device? The KAMRA corneal inlay.

Is SAI typically performed unilaterally, or bilaterally?
Unilaterally.

Is it usually performed on the dominant, or nondominant eye?
Nondominant.

How much myopic shift are we talking about here?
None. SAI do not change the refractive status of the eye!
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

Pseudophakic

Phakic IOL

Incisional

Laser

Corneal

Incisional Laser

PRK

LASEK

RK

AK

LRI

Refractive lens exchange (RLE)

LASIK

SMILE

Epi-LASIK

Other

CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities?

SAI and CRI are used to treat **presbyopia**, whereas CXL and ICRS are primarily used to treat **keratoconus**.

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A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 200 μm. The SAI is then placed under the flap/in the pocket, making sure that its aperture is centered on the line of sight.

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As of this writing, only one SAI is FDA approved. What is the name of this device?

The KAMRA corneal inlay

Is SAI typically performed unilaterally, or bilaterally?

Unilaterally

Is it usually performed on the dominant, or nondominant eye?

Nondominant

How much myopic shift are we talking about here?

None. SAI do not change the refractive status of the eye!

Is SAI typically performed unilaterally, or bilaterally?

Unilaterally

Is it usually performed on the dominant, or nondominant eye?

Nondominant

How much myopic shift are we talking about here?

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How is SAI performed?
A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 200 μm. The SAI is then placed under the flap/in the pocket, making sure that its aperture is centered on the line of sight.

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As of this writing, only one SAI is FDA approved. What is the name of this device?
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CK, SAI and CRI are used to treat presbyopia, whereas CXL and ICRS are primarily used to treat keratoconus.

The central aperture is 1.6 mm; how thick is the KAMRA?
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

Pseudophakic

Phakic IOL

Corneal

Incisional

Laser

Other

RK

RK

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The diameter of the central aperture is only 1.6 mm; thus, it increases the depth-of-focus of the eye, thus allowing the eye to see at near with affecting distance vision.

As of this writing, only one SAI is FDA approved. What is the name of this device?
The KAMRA corneal inlay.

The central aperture is 1.6 mm; how thick is the KAMRA?
About 6 microns

For comparison purposes, what is the diameter of a red blood cell?
About 6 microns
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

How is SAI performed?
A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 200 μm. The SAI is then placed under the flap/in the pocket, making sure that its aperture is centered on the line of sight.

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The central aperture is 1.6 mm; how thick is the KAMRA?
About 6 microns

For comparison purposes, what is the diameter of a red blood cell?
About 6 microns
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

Pseudophakic
Phakic IOL

Incisional

Corneal

Laser

Other

CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities?

CK, SAI and **CRI are used to treat presbyopia**, whereas CXL and ICRS are primarily used to treat **keratoconus**

**How is CRI performed?**

A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 150 \( \mu m \). The CRI is then placed under the flap/in the pocket.

**How does a CRI treat presbyopia?**

The CRI is shaped like a tiny ‘flying saucer’—thin at the edges, thicker centrally. This shape causes the central cornea to bulge slightly, making it more prolate (and thereby causing a myopic shift centrally).

As of this writing, only one CRI is FDA approved. What is the name of this device?

**The Raindrop Near Vision Inlay**
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

- Pseudophakic
  - Refractive lens exchange (RLE)
- Phakic IOL
- Incisional
  - RK
- Laser
  - PRK
  - LASEK
  - LASIK
  - Epi-LASIK

Corneal

- LASIK
- SMILE
- Other
  - CK
  - SAI
  - CRI
  - CXL

CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities?

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How is CRI performed?

A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 150 μm. The CRI is then placed under the flap/in the pocket.
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

Corneal

Corneal

Incisional

Laser

Other

Pseudophakic

Phakic IOL

Incisional

Laser

Other

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A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 150 μm. The CRI is then placed under the flap/in the pocket.

How does a CRI treat presbyopia?
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular
- Pseudophakic
- Phakic IOL

Corneal
- Incisional Laser
  - RK
  - PRK
- Laser
  - RPK
- Other
  - CK
  - SAI
  - CRI
  - CXL
  - LASIK

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Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

**Refractive Surgery**

- Intraocular
  - Pseudophakic
  - Phakic IOL
- Corneal
  - Incisional
    - RK
  - Laser
    - PRK
    - LASEK
    - LASIK
    - SMILE
    - Epi-LASIK
- Other
  - CK
  - SAI
  - CRI
  - CXL

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**As of this writing, only one CRI is FDA approved. What is the name of this device?**

The Raindrop Near Vision Inlay (although as of this writing, the parent company has stopped production)
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

**Refractive Surgery**

**Intraocular**
- Pseudophakic
- Phakic IOL

**Corneal**
- Incisional
  - RK
- Laser
  - PRK
  - LASIK
  - LASEK
- Other
  - CK
  - SAI
  - CRI
  - ICRS
  - CXL
  - CRI

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The Raindrop Near Vision Inlay (although as of this writing, the parent company has stopped production).
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

Pseudophakic

Phakic IOL

Incisional

Laser

Corneal

Other

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As of this writing, only one CRI is FDA approved. What is the name of this device?
The Raindrop Near Vision Inlay (although as of this writing, the parent company has stopped production)

Is CRI typically performed unilaterally, or bilaterally?
Unilaterally
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

- Pseudophakic
- Phakic IOL

Corneal

- Incisional
- Laser

Other

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**How does a CRI treat presbyopia?**

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**Is CRI typically performed unilaterally, or bilaterally?**

Unilaterally

**Is it usually performed on the dominant, or nondominant eye?**

Nondominant

As of this writing, only one CRI is FDA approved. What is the name of this device?

The Raindrop Near Vision Inlay (although as of this writing, the parent company has stopped production).
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

- Pseudophakic
- Phakic IOL

Corneal

- Incisional
- Laser

Other

- RK
- PRK
- LASIK
- CXL
- ICRS

CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities?
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A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 150 μm. The CRI is then placed under the flap/in the pocket.

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As of this writing, only one CRI is FDA approved. What is the name of this device? The Raindrop Near Vision Inlay (although as of this writing, the parent company has stopped production)
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

Pseudophakic

Phakic IOL

Incisional

Laser

Other

Corneal

Refractive lens exchange (RK, PK)

Incisional LASIK, SMILE, Epi-LASIK

Laser PRK, LASEK

Iris-fixated

Intraocular Pseudophakic Phakic IOL

RK

AK

LRI

Sulcus-fixated

Refractive lens exchange (RLE)

LASIK

SMILE

Epi-LASIK

Other

CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities?

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How does a CRI treat presbyopia?

The CRI is shaped like a tiny ‘flying saucer’--thin at the edges, thicker centrally. This shape causes the central cornea to bulge slightly, making it more prolate (and thereby causing a myopic shift centrally).

As of this writing, only one CRI is FDA approved. What is the name of this device?

The Raindrop Near Vision Inlay (although as of this writing, the parent company has stopped production). How tiny is the Raindrop? What is its diameter?

2 mm

What is its thickness:

At the edge? 10 microns

Centrally? 32 microns
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular
- Pseudophakic
  - Refractive lens exchange (CK)
- Phakic IOL
- Incisional
  - RK
- Laser
  - PRK
  - LASEK
  - LASIK
  - SMILE
  - Epi-LASIK

Corneal
- Other
  - CK
  - SAI
  - CRI
  - ICRS
  - CXL
  - CRI

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How is CRI performed?
A femtosecond laser is used to create a flap or pocket in the central cornea at a depth of about 150 μm. The CRI is then placed under the flap/in the pocket.

How does a CRI treat presbyopia?
The CRI is shaped like a tiny ‘flying saucer’—thin at the edges, thicker centrally. This shape causes the central cornea to bulge slightly, making it more prolate (and thereby causing a myopic shift centrally).

How tiny is the Raindrop? What is its diameter?
2 mm

How thick is the Raindrop?
At the edge: 10 microns
Centrally: 32 microns

As of this writing, only one CRI is FDA approved. What is the name of this device?
The Raindrop Near Vision Inlay (although as of this writing, the parent company has stopped production)
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

Refractive Surgery

Intraocular

- Pseudophakic
- Phakic IOL
- Refractive lens exchange (RLE)

Corneal

- Incisional
  - RK
- Laser
  - PRK
  - LASEK
  - LASIK
  - SMILE
  - Epi-LASIK
- Other
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Refractive Surgery

Intraocular

Pseudophakic

Phakic IOL

Incisional

Laser

Corneal

Sulcus-fixated

Refractive lens exchange (RLE)

Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

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At the edge? 10 microns
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Does the gradual peripheral-to-central thickening of the Raindrop inlay play a role in how it affects vision?
Yes. Its effect is strongest centrally, and tapers to nothing past its edge. In essence, the Raindrop transforms the cornea into a multifocal device in terms of its focusing power.

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In essence, like a multifocal CL/IOL. It is ring-shaped (ie, has a central aperture). This allows rays from distant objects to pass through unrefracted (by the device). The doughnut-shaped device itself consists of rings of increasing plus power, and these rings of added plus power produce the presbyopia-correcting effect.

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Refractive Surgery

Intraocular

Corneal

Pseudophakic

Refractive lens exchange (RLE)

Other

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The fact that rays from distance are unaffected implies what about the refractive status of the eye? That it is emmetropic. Because of this, most surgeons will implant the Flexivue only if the pt is emmetropic in both eyes.
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*In one word, what sort of condition is keratoconus (KCN)?*

CK, SAI and CRI have something in common. Likewise, CXL and ICRS do too. What are these respective commonalities? CK, SAI and CRI are used to treat **presbyopia**, whereas CXL and ICRS are primarily used to treat **keratoconus**.

**Other**
- CXL
- SAI
- CRI
- ICRS

**Refractive Lens Exchange (RLE)**
- PRK
- LASEK
- RK
- AK
- LRI
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- SMILE

**Pseudophakic**
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In addition to KCN, what are the two other main ectatic conditions for which CXL is used?

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--Pellucid marginal degeneration
--Ectasia after keratorefractive surgery

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What corneal problem, fundamental to KCN, is addressed by CXL?: In normal corneal stroma, collagen fibrils are arranged in tightly packed, orderly lattices. These lattices are disrupted in KCN, which allows the cornea to progressively warp. CXL tightens the bonds among corneal fibrils, thereby preventing further warpage and thus halting dz progression.
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What does corneal topography reveal about the typical dz course in KCN?
The central and/or paracentral cornea thins progressively, producing a cone-like bulge. Extreme irregular astigmatism eventually results.

At what age does the dz tend to progress most rapidly?
Adolescence

What corneal problem, fundamental to KCN, is addressed by CXL?
In normal corneal stroma, collagen fibrils are arranged in tightly packed, orderly lattices. These lattices are disrupted in KCN, which allows the cornea to progressively warp. CXL tightens the bonds among corneal fibrils, thereby preventing further warpage and thus halting dz progression.

Briefly, how is CXL performed?
After removal of the corneal epithelium, the stroma is suffused with riboflavin, then subjected to UV radiation. The riboflavin acts as a photosensitizer, absorbing the radiation and producing reactive oxygen species. The reactive oxygen species cause cross-linking to occur among fibrils, stiffening the cornea.
In one word, what sort of condition is keratoconus (KCN)?
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Does this dramatic increase in stiffening flatten the cone?
Actually, no. Post CXL, the cornea may be slightly flatter, but not significantly so.

If it doesn't flatten the cone, what's the point of CXL?
To halt disease progression, as well as render the eye a better candidate for vision-rehabilitating interventions such as...
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- Refractive Surgery
  - Intraocular
    - Pseudophakic
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    - Incisional
    - Laser
      - RK
      - PRK
      - LASIK
      - SMILE
      - Epi-LASIK
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Corneal

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*In some cases of KCN, the area of inferior steepening is more peripheral and is accompanied by an area of abnormal flattening of the superior cornea, 180° away. In such a situation, what approach might the surgeon take?*

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What is the name for this phenomenon wherein ICRS flattening of the inferior cornea produces desired steepening of a too-flat superior cornea?

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No! The coupling effect refers to steepening that occurs 90° away from AK incisions and LRIs, whereas the beanbag effect occurs 180° away, and in response to the placement of an ICRS. Don’t get the two confused!

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What exactly are ICRS, and how do they reduce astigmatism and myopia?
They are semicircular segments of PMMA that are slipped into channels created within the mid-peripheral cornea. By displacing some of the stroma, they cause local flattening the cornea.

As of this writing, only one brand of ICRS is FDA-approved. What is that brand?
Intacs
Corneal Inlay, Collagen Shrinkage, and Cross-linking Surgery

**Refractive Surgery**

**How is the flattening effect titrated?**

By selecting segments that differ in thickness. That is, the inner and outer radius-of-curvature of Intacs segments do not vary among the different ‘powers.’ What **does** vary is the thickness of the segments (As of this writing, Intacs come in eight thicknesses.)

**What is the name for this phenomenon wherein ICRS flattening of the inferior cornea produces desired steepening of a too-flat superior cornea?**

The **beanbag effect**, so-called because it is reminiscent of what happens to the other end of a beanbag chair when one plops down on one end of it.

**ICRS have three main advantages over other forms of keratorefractive surgery. What are they?**

- No corneal tissue is removed
- It is reversible (i.e., the ICRSs can be removed)
- It is performed on the corneal periphery, so the central cornea is not disturbed

That said, the procedure **what** is the main downside to the procedure?

It is unlikely to result in good UCVA by itself

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In fairness, good UCVA is not the goal of ICRS placement; rather, what is the goal?

Correction of the astigmatism and anisotropia induced by KCN.

What is the hallmark of KCN? The beanbag effect is reminiscent of what happens to the other end of a beanbag chair when one plops down on one end of it. So this is the same as the ‘coupling effect’ that occurs during arcuate keratotomy (AK) and the creation of limbal relaxing incisions (LRIs), yes? No! The coupling effect refers to steepening that occurs 90° away from AK incisions and LRIs, whereas the beanbag effect occurs 180° away and in response to the placement of an ICRS. Don’t get the two confused!

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In some cases of KCN, the area of inferior steepening is more peripheral and is accompanied by an area of abnormal flattening of the superior cornea. 180° away. In such a situation, what approach might the surgeon take? To place a single, unpaired Intacs in the inferior cornea, the effect of which will be to flatten the inferior cornea and steepen the superior cornea.

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In fairness, good UCVA is not the goal of ICRS placement; rather, what is the goal?

By flattening the cornea and reducing astigmatism (especially irregular astigmatism), the hope is that the pt can once again have his/her refractive error adequately corrected by RGPs, or even spectacles

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