

PIEZO ICSI

Patient Information Sheet

What is PIEZO ICSI?

Intra-Cytoplasmic Sperm Injection (ICSI) is a treatment for male infertility where a good quality sperm is picked up with a sharp glass needle and injected into the egg. ICSI has been used in human IVF since 1992 and has been shown to be an effective means of assisting fertilisation when the number of normal looking motile (rapidly swimming) sperm are low.

During conventional ICSI a sharp bevelled needle is used to inject a sperm into the egg by puncturing the zona pellucida (shell of the egg). The needle is then placed into the centre of the egg and the IVF scientist applies suction to help rupture the egg membrane, before injecting the sperm. While this process works well for the majority of eggs, it is recognised to be a process that can result in damage to the egg (lysis). Older women with fragile eggs may be particular susceptible to loss of eggs due to ICSI damage⁽¹⁾.

In PIEZO ICSI the blunt needle is guided into the egg by an ultra-fast vibrating motion under light pressure. This pressure moves the needle head many times per second, helping “drill” the blunt needle through the zona pellucida outer coat and then into the egg. This drilling action of the PIEZO needle is less traumatic to an egg than the puncture and aspiration process used in conventional ICSI (see image below for difference between two types of injection needles and techniques).

PIEZO ICSI was initially developed over 20 years ago in mouse IVF where it was noted that the use of sharp conventional ICSI needles damaged the very fragile mouse eggs, but the gentler PIEZO ICSI technique resulted in excellent fertilisation rates, with very few eggs lost to lysis⁽²⁾. After successful use in animals, PIEZO ICSI started to be used in human IVF soon after^(3,4).

The photo below demonstrates the difference between conventional ICSI and PIEZO ICSI.

What are the potential advantages of PIEZO ICSI over routine IVF or ICSI?

PIEZO ICSI has been used by several IVF clinics in Japan for many years with excellent results⁽³⁻⁶⁾, but very few IVF units outside of Japan currently use PIEZO. In 2019 Monash IVF Group recognised the potential advantages of this technique and conducted its own trial of PIEZO ICSI. In this trial PIEZO produced a superior fertilisation rate compared to traditional ICSI (85% v 66%), with fewer eggs being damaged in the process (3.8% v 9.0%)⁽⁷⁾. The embryo quality and pregnancy rates were comparable with both ICSI techniques, with the pregnancy rates being equal compared to the normal ICSI group.

The long-term data from Japanese IVF clinics using PIEZO ICSI shows a similar fertilisation advantage from PIEZO ICSI as seen in the Monash IVF Group trial, with some Japanese studies even suggesting superior live birth rates⁽³⁻⁶⁾. While we are confident that PIEZO ICSI produces superior fertilisation rates compared to traditional ICSI, it is not yet certain if pregnancy rates are superior with PIEZO ICSI created embryos when analysed on a per embryo transferred basis. However, as PIEZO ICSI appears to improve fertilisation rates without negatively impacting embryo quality, it is probable that PIEZO ICSI will lead to the generation of more good quality embryos from each stimulated IVF cycle. This may translate into a higher cumulative pregnancy rate from all the fresh and frozen transfers using embryos generated from one stimulated cycle of IVF.

While there have been nine published studies on the use of the technology, all of which showed an equal or better safety profile of PIEZO ICSI, all studies have limitations. There may be certain patients who do not benefit from the technology, but these are yet to be identified. Monash IVF Group will continue to monitor the ongoing use and safety of the technology.



Who may most benefit from PIEZO ICSI?

Two groups of patients are most likely to benefit from PIEZO ICSI:

1. Poor fertilisation results with past conventional ICSI. Some women's eggs are particularly fragile and may break open (lyse) with traditional ICSI. Previous research has suggested that women older than 38 Years may have more fragile egg membranes prone to lysis with traditional ICSI⁽⁷⁾. In these patients PIEZO ICSI should be considered.
2. Low egg number. Any technique that boosts fertilisation rate, thereby generating more embryos for potential transfer, is likely to be a significant advantage when only a few eggs are retrieved in the IVF cycle. Therefore, if your treating doctor anticipates you may produce a low number of mature eggs in your cycle, they may suggest PIEZO ICSI rather than traditional ICSI.

Has PIEZO ICSI been shown to be safe?

PIEZO ICSI has been used for human IVF in Japan for over two decades with a safety record comparable to conventional ICSI⁽³⁻⁶⁾. Monash IVF Group has used PIEZO ICSI since 2019 in over 500 cases to date with no adverse outcomes relating to the PIEZO ICSI technology, including no differences in the babies born from PIEZO ICSI compared to convention ICSI^(7 & 9, 10). However, as PIEZO ICSI is a relatively new treatment pioneered by Monash IVF Group in Australia, we currently only have limited live birth outcomes. The PIEZO supplier is working through the process to obtain TGA approval for the technology. Until such time as that approval is granted, Monash IVF Group are able to apply to the TGA Special Access Scheme, to permit the use of the technology in your treatment cycle. This application requires your Patient ID Number, Initials and Date of birth of the person providing the eggs to be submitted, your full identifying information is not shared.

What is the cost of PIEZO ICSI?

The cost of the PIEZO equipment is significantly more than traditional ICSI needles. Furthermore, the time taken for embryologists to complete PIEZO ICSI is also greater than traditional ICSI. For these reasons, the use of PIEZO ICSI will incur an additional cost to your cycle. It's recommended that you contact your local clinic for more information on this cost.

What should I do if I have more questions?

If you have any further questions regarding whether PIEZO ICSI is suitable for you, we suggest you discuss this with your treating doctor who knows your clinical situation best.

References

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